Annual Report

OF THE

AMERICAN INSTITUTE

OF THE

City of New York

FOR THE YEARS

1869-70.

Albany
The Argus Co., Printers.
1869.

A

THIRTIETH ANNUAL REPORT

OF THE

AMERICAN INSTITUTE,

OF THE

CITY OF NEW YORK,

FOR THE

Year 1869-70.

ALBANY:
THE ARGUS COMPANY, PRINTERS.
1870.

STATE OF NEW YORK.

No. 212.

IN ASSEMBLY,

April 13, 1870.

TRANSACTIONS OF THE AMERICAN INSTITUTE.

American Institute,
New York, *April* 12*th*, 1870.

To the Hon. William Hitchman,

Speaker of the Assembly of the State of New York:

Sir—I transmit herewith the Annual Report of the American Institute of the city of New York, for the year ending in April, 1870.

I have the honor to remain, very respectfully,

Your obedient servant,

SAMUEL D. TILLMAN,

Corresponding Secretary.

AMERICAN INSTITUTE.

OFFICERS AND COMMITTEES—1870.

TRUSTEES.

PRESIDENT,
HORACE GREELEY.

VICE-PRESIDENTS,
WILLIAM HALL,
CHARLES P. DALY,
NATHAN C. ELY.

RECORDING SECRETARY,
GEORGE PEYTON.

CORRESPONDING SECRETARY,
SAMUEL D. TILLMAN.

TREASURER,
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J. TRUMBULL SMITH,
WALTER SHRIVER,
THOS. D. STETSON,
JAMES R. SMITH,
CHARLES E. BURD,
E. S. DICKINSON,
CHARLES H. CLAYTON,
HENRY J. NEWTON,
THOMAS VARKER,
ALEX. M. EAGLESON,
FRANK EVERDELL.

COMMITTEES.

Admission of Members—Thomas C. Smith, James H. Drake, John W. Chambers, J. Owen Rouse, Stephen R. Krom.

Finance—Thomas M. Adriance, Thomas Williams, Jr., Charles Chamberlain, Simeon Baldwin, J. De Lamater.

Library—James K. Campbell, Edward Walker, Dubois D. Parmelee, Oscar G. Mason, Stephenson Towle.

Repository—M. M. Livingston, Albro Howell, Nathaniel Wheeler, Frank A. Butler, C. Williams.

Manufactures and Machinery—Hamilton E. Towle, Charles E. Emery, George H. Babcock, Frank L. Pope, Robert Weir.

Chemistry, Mineralogy and Geology—Charles F. Chandler, Dubois D. Parmelee, Julius G. Pohlé, J. S. Newberry, Albert G. Kelley.

Optical Science—John B. Rich, John E. Gavit, John Frey, L. Bradley, P. H. Vanderweyde.

Civil Engineering and Architecture—William J. McAlpine, Robert G. Hatfield, Hamilton E. Towle, Samuel McElroy, Edward S. Renwick.

Agriculture—Nathan C. Ely, John Crane, P. T. Quinn, F. M. Hexamer, Josiah H. Macy.

Horticulture—William S. Carpenter, Benjamin C. Townsend, John Henderson, Isaac Buchanan, James Hogg.

Commerce—J. V. C. Smith, Lewis Carr, Thomas Godwin, James H. Sackett, Alex. M. Eagleson.

REGENTS OF THE AMERICAN INSTITUTE.

EDWIN D. MORGAN,
GERRIT SMITH,
CORNELIUS VANDERBILT,
EZRA CORNELL,
ABIEL A. LOW,
DENNING DUER,
SAMUEL F. B. MORSE,
HAMILTON FISH,
HENRY W. BELLOWS,
HENRY WARD BEECHER,
WILLIAM H. APPLETON,
ORLANDO B. POTTER,
JOHN A. GRISWOLD.

REGENTS EX-OFFICIO.

THE GOVERNOR OF THE STATE OF NEW YORK.
THE MAYOR OF THE CITY OF NEW YORK.
THE U. S. SECRETARY OF THE INTERIOR.
THE TRUSTEES OF THE AMERICAN INSTITUTE.

FACULTY.

SAMUEL DYER TILLMAN, LL. D., Professor of Mechanical Philosophy and Technology.

JULIUS G. POHLÉ, M. D., Professor of Analytical Chemistry.

ROBERT P. STEVENS, M. D., Professor of Geology and Mineralogy.

JAMES A. WHITNEY, A. M., Professor of Agricultural Chemistry.

OFFICERS.

JOHN W. CHAMBERS, Clerk and Librarian.
EDWARD C. HUSBANDS, Messenger.

COMMUNICATION TO THE LEGISLATURE.

To the Honorable the Legislature of the State of New York:

The undersigned, in presenting the thirtieth annual report of the American Institute of the city of New York, beg leave to state that its transactions for the year ending in April, 1870, are very fully and clearly set forth in the annexed documents, which contain,

I. The report of the retiring Trustees, made at the last annual meeting of the Institute, held February 3d, 1870.

II. An exhibit of receipts and expenditures.

III. The action of several standing committees.

IV. The operations of the Board of Managers, including a list of awards made at the last Industrial Exhibition.

V. Addresses delivered before the Institute during the Exhibition.

VI. Scientific lectures delivered before the Institute in the Great Hall of the Cooper Union.

VII. The discussions of the Farmers' Club, including a large portion of its extensive correspondence.

VIII. The transactions of the Polytechnic Association, embracing descriptions of new inventions, and notes on the progress of scientific investigations, at home and abroad.

IX. The proceedings of the Photographical Section of the American Institute.

All of which is respectfully submitted.

HORACE GREELEY, *President.*
CHAS. P. DALY,
WM. HALL,
NATHAN C. ELY,
GEO. PEYTON,
SAM'L D. TILLMAN,
S. R. COMSTOCK,
Trustees of the American Institute.

NEW YORK, *April 12th*, 1870.

ANNUAL REPORT

OF THE

BOARD OF TRUSTEES,

MADE AT THE

ANNUAL MEETING OF THE INSTITUTE, FEBRUARY 3, 1870.

The Trustees have the satisfaction of reporting that the financial condition of the Institute is even more favorable than they had anticipated. Surplus funds up to this date have been sufficient to purchase forty thousand dollars of United States bonds. For a detailed account of receipts and expenditures during the past year, reference is made to the statement of the Committee on Finance. The unincumbered real estate in Broadway and Leonard street, belonging to the Institute, could not be disposed of, since no offer for it has yet reached the sum below which the Trustees are directed by resolution not to sell. Its actual value will not soon decrease, because it is located within the most valuable part of the city area devoted to wholesale trade. Owing to a depression of business, rents are lower, and the Trustees have been compelled to let this property at a less rate than that received for the past two years.

By the action of the Institute, to which allusion was made in the last annual report of the Trustees, in relation to providing space for an exposition by the National Association of Wool Manufacturers to be given under the auspices of the Institute and in connection with its own exhibition, new and extraordinary duties were imposed on the present Board of Managers. They met the emergency by securing for the joint exhibition the largest structure to be obtained, although it was located more than four miles from the City Hall, and its enlargement involved the outlay of more money than had before

been expended by the Institute for such a purpose. This bold undertaking was looked upon by many with distrust, since no previous attractions had been potent enough to draw large crowds continuously to that point. Yet the result confirmed the foresight and judgment of the managers. The gross receipts of their undertaking amounted to more than sixty-one thousand dollars, and the net proceeds, including the sum expended for buildings and materials to be used for the exhibition of 1870, exceeded, by several thousand dollars, the profits of the successful preceding fair.

To the energy, watchfulness and self-devotion of a majority of the present Board of Managers, and to the good taste and executive ability of the officers of the National Association of Wool Manufacturers, the institution is chiefly indebted for the most complete and satisfactory display of American productions ever made, and for its financial success.

Reports from the several standing committees will show that all the other departments of the Institute have evinced commendable activity during the past year. Unabated interest has been kept up in the weekly proceedings of the Farmer's Club and the Polytechnic Association, as well as in the monthly meetings of the Photographical Section.

Large additions of valuable scientific works have recently been made to the library, which now occupies nearly all the available space in the rooms at present occupied by the Institute. The most certain and gratifying evidence of the increasing influence of our organization, is formed in the very large accession of new members during the past year.

In accordance with the desire expressed at the close of the course of scientific lectures, delivered before the Institute last winter, the Trustees made arrangements for a similar, but shorter, course for the present season, and the following programme of the lecturers was issued:

I. Friday, December 17th, 1869. "The Battle Fields of Science." By Andrew White, President of Cornell University, Ithaca, N. Y.

II. Friday, December 24th, 1869. "How Animals Move." By Professor E. S. Morse, of the Peabody Academy of Science, Salem, Mass.

III. Friday, December 31st, 1869. "The Correlation of Vital and Physical Forces." By Professor G. F. Barker, of Yale College, New Haven, Conn.

IV. Friday, January 7th, 1870. "The Air and Respiration." By Professor J. C. Draper, of the College of the City of New York.

V. Friday, January 14th, 1870. "The Connection of Natural Science and Mental Philosophy." By Professor J. Bascom, of William's College, Williamstown, Mass.

VI. Friday, January 21st, 1870. "The Constitution of the Sun." By Dr. B. A. Gould, of Cambridge, Mass.

VII. Friday, January 28th, 1870. The Colorado Plateau; its Canons and Ruined Cities." By Professor J. S. Newberry, of Columbia College, New York.

It will be observed that this list only contains lecturers who had not previously appeared before the Institute. The whole programme was carried out with no change or failure, and at an expense not exceeding one-half of that incurred for the preceding course. The audiences, at these lectures, consisted mainly of members of the Institute, and their families; and as the attendance was uniformly large, it may be regarded as fortunate that this means has been devised for drawing together, at least for a few nights of each year, those who evince a fondness for scientific investigations.

The twenty-ninth annual report of the American Institute to the Legislature of the State, which has been in the process of printing since the close of the exhibition, is just completed, and will be delivered to members within a few days. It is the largest, and, without doubt, the most varied and valuable volume of Transactions ever issued by this institution.

Respectfully submitted.

HORACE GREELEY,
DUDLEY S. GREGORY,
CHARLES P. DALY,
CYRUS H. LOUTREL,
GEORGE PEYTON,
SAMUEL D. TILLMAN,
SYLVESTER R. COMSTOCK,
Trustees.

New York, *February 3d*, 1870.

REPORTS OF COMMITTEES.

FINANCE.

Receipts and Disbursements of the American Institute of the City of New York, for the year ending January 31st, 1870.

Balance in bank January 31, 1869		$5,004 67
RECEIPTS.		
Rental of property	$18,500 00	
Admission fees, dues, and from life members	4,695 00	
State appropriation, 1868	2,315 63	
Interest on investments	2,229 97	
From managers of 38th annual fair	15,000 00	
Miscellaneous sources	33 01	
		42,773 61
		$47,778 28
DISBURSEMENTS.		
Taxes and assessments on property	$2,587 00	
Fire insurance and repairs	311 04	
Books, periodicals and binding	284 81	
Rent of rooms at Cooper Union and gas light	2,214 70	
Printing and stationery	117 36	
Freight and expenses—Transactions from Albany	39 26	
Balance course of scientific lectures, 1868 and '69	777 36	
On account of course of scientific lectures, 1869 and '70	767 00	
Reporting for Polytechnic and Photographical Sections	114 00	
Appropriation to chairman of Finance Committee, Board of Managers	250 00	
Salaries	4,378 00	
Carried forward	$11,840 53	$47,778 28

Brought forward	$11,840 53	$47,778 28
Newspapers, advertising, postage and incidental expenses	534 76	
	$12,375 29	
Invested in U. S. 5-20 bonds of 1867, 1868.	34,630 00	
		47,005 29
Balance in bank January 31, 1870		$772 99

THOMAS M. ADRIANCE,
THOMAS WILLIAMS, Jr.,
CHARLES CHAMBERLAIN,
SIMEON BALDWIN,
J. DE LAMATER,
Finance Committee.

ADMISSION OF MEMBERS.

The Committee on the Admission of Members respectfully submit their annual report.

Great activity has prevailed during the year in regard to the admission of new members. The number admitted are greatly in excess of the previous year.

This large increase of members must be very gratifying to the well wishers of the American Institute, and is well calculated to inspire us all with new zeal, and brighten our hopes for the future.

If this state of affairs continue, year after year, it would seem impossible to measure the future greatness of this institution.

A large number of persons availed themselves of the opportunity to join the Institute during the last exhibition; 296 propositions were received by the Board of Managers, and at the November meeting were admitted as members.

The following table shows the number admitted at each monthly meeting:

March, 1869	14
April, "	11
May, "	13
June, "	6
September, "	40
November, "	296
December, "	33

January, 1870	32
February, "	34
Total	479

The following is the number of members belonging to the Institute:

Honorary members		85
Corresponding members		248
Life members	1,272	
Less deceased	246	
		1,026
Annual members		1,696
Total		3,055

The committee would respectfully suggest the propriety of each member who indorses candidates to make it convenient to accompany them to the rooms of the Institute at the next meeting after their election, and introduce them to the officers and others present, and thereby give them welcome.

All of which is submitted.

CHARLES E. BURD,
JAMES H. DRAKE,
JOHN W. CHAMBERS,
J. OWEN ROUSE,
S. R. KROM,
Committee.

NEW YORK, *February* 3, 1870.

AGRICULTURE.

The Committee on Agriculture report, that their official duties have been confined to, and connected with the Farmer's Club, which continues to be crowded each week with an interested audience, and its usefulness is acknowledged in thousands of letters received from every State and territory of our country. During the year many valuable and interesting papers have been read upon particular subjects connected with stock raising, agriculture and fruit growing, by Dr. J. V. C. Smith, Prof. J. A. Whitney, J. B. Lyman, Esq., Dr. F. M. Hexamer, A. S. Fuller, Esq., Prof. Horsford, of Cambridge,

Dr. Lemercier of Paris and others; and to the press of the city, much is due for their elaborate reports of the transactions of the club. During the year, committees from the club have visited various places in our own State, Connecticut, New Jersey, Pennsylvania, Virginia, South Carolina, Georgia and Florida, and much valuable information has been obtained as to soils, crops, fruits and other matters of great importance to agriculturists. In no case has the treasury of the American Institute been called upon to pay one cent for expenses incurred by any of these committees.

As the doings of the Farmer's Club are published in the Transactions of the American Institute, at considerable length, your committee do not deem it important to extend this report.

All of which is respectfully submitted.

NATHAN C. ELY,
P. T. QUINN,
JOHN CRANE,
JOSIAH H. MACY,
SERENO EDWARDS TODD,
Committee.

NEW YORK, *February 3d*, 1870.

MANUFACTURES AND MACHINERY.

The Committee on Manufactures and Machinery respectfully submit the following report:

Your committee has for several years past confined its attention to the successful working of the Polytechnic Association. No subjects have been specially referred to the committee by the Institute, and as we believe it generally impracticable, with the limited time and facilities for investigation at the disposal of such a committee, to give absolutely reliable and authoritative reports on new inventions or the like, such as should go abroad, with the name and prestige of the American Institute, we believe it impolitic for the Institute to refer matters to this committee, except there shall exist some very unusual reason for such an investigation.

The Polytechnic Association has increased in interest and in the numbers attending. The room has been filled on nearly every meeting. The meetings have been kept up every Thursday evening, with the exception of the usual recess during the summer months,

and with the omission of those nights on which the Institute meetings are held.

In addition to the notes made by the talented and indefatigable chairman, Professor Tillman, which are devoted more particularly to the progress of inventions and discoveries abroad, there has been a large number of important and interesting subjects brought forward by the members, and by visitors, generally those familiar with, and in many cases interested in, the inventions or manufactures. These subjects have been discussed, and the results reported to the world through several newspapers, in addition to the official report, which will ultimately appear in our Transactions. Among the subjects thus exhaustively considered, may be found those of universal importance, applying in every household, and we may almost say to every individual, such as ventilation, burners for lamps, safety of oils, and mode of testing, disinfectants, poisons, paints in their sanitary relations, vapor stoves, Dr. Leigh's new mode of teaching the art of reading, hygrometry and predictions of weather, observations on bees and other insects relating to weather, nitrous oxyd gas for medicinal purposes, sun-flower seed oil and other heretofore little valued oils the best oils for leather, and burglar alarms as a safeguard for dwellings and property.

Passing over many interesting discussions of what may, by some, be considered higher branches of science, as the formation of features revealed by the telescope on the moon, the cause and relations to magnetism of the aurora borealis, the solar spectra, and the relations of light and color to sound, the association has, by its unparalleled facilities for comparing the observations and opinions of men, brought together from greatly varied relations to the arts, developed and diffused practical information on the propelling of vessels; the harbor of New York and the plans for improving it; geology, generally, and particularly that of the highly productive gold fields of Venezuela, just professionally examined by one of the members; the Suez canal, and the artificial stone of lime and desert sand employed therein; artificial stone ornaments; deep sea soundings and modes for facilitating the same; sand and its different natures and uses; plastering by machinery; street cleaning; the relative values of high and low pressure of steam; corrosion of steam boilers and modes of preventing the same; furnaces, and fuel saving; avoiding of smoke in furnaces; steam boiler coverings; steam engines generally, and modes of testing them; steam plowing; steel springs, and the

inefficiency of any springs for driving sewing machines and analogous uses; velocipedes as compared to other modes of locomotion; portable gas and apparatus for making it; nickle plating and its advantages over silver and any other known material; sawing, especially by chain saws; enameled iron and its different degrees of strength and flexibility; and means for making the calcium light (ordinarily called the Drummond light) permanent and efficient.

Your committee congratulate the Institute on the high degree of usefulness of this branch of its labors, and believe that there are few channels in which its energies can be directed, which are more beneficial to the community in general, or more interesting to those immediately connected, than the Polytechnic Association of the American Institute, as at present conducted.

Respectfully submitted.

THOMAS D. STETSON,
HAMILTON E. TOWLE,
CHARLES E. EMERY,
WALTER SHRIVER,
Committee.

New York, *February 3d*, 1870.

LIBRARY.

The Committee on the Library, in again presenting their annual report, congratulate the nstitute on the large addition of very valuable books, which they have been enabled to place on the shelves of the library during the past year. Few libraries in the country, we believe, possess a superior collection of valuable works on science and art, furnishing no ordinary facilities for the study of those great subjects to which the lives of scientific men are devoted, studies which promise such happy results to the human family. Every year is producing new discoveries in science and art; and as it is the noble end and design of the American Institute to aid and encourage the advancements of scientific knowledge and study, the committee on the library have been anxious to carry forward this great and noble purpose, by procuring the most recent and valuable works published in our own and in other lands on science and art.

The whole number of volumes in the library at the date of the last report was		9,423
Added during the year by purchase	66	
Donations and exchanges	45	
		111
Making the total number of volumes in the library		9,534

The Library Committee take great pleasure in informing the Institute that they have just received from London, an invoice of 102 volumes of choice scientific works, which cost there £74 10s. 8p. sterling; in a few days we expect the balance of the order.

To meet the payment for these books the Library Committee will require, in addition to the balance of the last appropriation, a further appropriation of $500.

A supplement of the catalogue has been prepared under the supervision of the librarian, but has been delayed for the purpose of adding the foregoing important addition to the library. There are on hand about 400 copies of the old catalogue and supplement in sheets, the Library Committee respectfully ask authority of the Institute to print the new supplement, and have the entire work bound. The printing and binding is estimated to cost about $500. This amount can be met by charging the members a nominal price, say one dollar per volume; this we find is the custom of other libraries. Were a copy to be distributed to each of the members, it would require a large expenditure. Those who wish to consult the catalogue will always find copies in the rooms. The cases that were erected two years ago have nearly all been filled; and at no distant date, further authority will be required to erect some additional ones.

All of which is respectfully submitted.

JAMES K. CAMPBELL,
WM. HIBBARD,
DUBOIS D. PARMELEE,
SAMUEL D. TILLMAN,
Library Committee.

NEW YORK, *February 2d*, 1870.

REPORT OF THE BOARD OF MANAGERS.

The Board of Managers respectfully report, that on the 15th day of February, 1869, four days after their election, the Managers met at the rooms of the Institute, and organized the Board for the ensuing year, by making Mr. Orestes Cleveland permanent chairman, Mr. Wm. H. Butler vice-chairman, and Mr. John W. Chambers secretary. The Institute, at a regular meeting, on the 5th of November, 1868, having referred the question of providing accommodations for the National Association of Wool Manufacturers, who proposed to hold an exposition of the wool industry of the country, under the auspices of the American Institute, and in conjunction with its regular exhibition, a sub-committee of Managers was immediately appointed to confer with the officers of that association. On the 15th of February, Mr. Thomas McElrath, from the committee, reported that the National Association of Wool Manufacturers, required at least 15,000 square feet of floor space for their exposition. It being evident that no place, before occupied by the American Institute, would be capacious enough for the next exhibition, the Board determined to seek new quarters. To erect a building of requisite dimensions in time for the autumnal exhibition was quite out of the question, but it was ascertained that by adding a large temporary structure to the Empire skating rink, situated on the 3d Avenue, between 63d and 64th streets, and having the dimensions of 170 by 350 feet, the whole would probably afford ample accommodations. Accordingly on the 15th day of March, it was resolved to rent the rink during the months of September and October, for the sum of $6,000, and pay any extra insurance which might be required of its owners. A contract was immediately thereafter made for the erection of a temporary building, 54 by 170 feet, which the Board, at its option, could use for two months, or could purchase outright for the sum of $4,000. One quarter of the great hall having been set apart for the use of the National Association of Wool Manufacturers, it was ascertained by the first of September, that the part remaining for the use of the

Institute, could not accommodate all who desired to become exhibitors, and the Board thereupon decided to make another addition of 20 by 170 feet. In this all the boilers, and other apparatus requiring fire, were located, while the remaining part of the new building was devoted to steam engines and machinery in motion. A few light machines, whose operation did not depend on a very solid foundation, were placed at the east end of the rink, and as near as possible to the driving power. For the first time in many years the Managers were enabled to devote ample space for the movement of visitors. A wide promenade extended through the middle of the main hall, and at convenient distances were other parallel avenues of less width. The exhibition tables were placed transversely to these avenues, and the spaces between formed a series of passages extending across the lower and main floor. All the available room for the use of exhibitors was equitably divided into seven portions, and were respectively occupied by the seven departments into which the exhibition was divided. Each department was under the immediate control of a sub-committee of three Managers, whose names will be found in the appendix to this report. The buildings were opened for the reception of goods on the 1st day of September, and on the 8th they were opened to the public. As is usually the case, several days elapsed before all the engines and machinery were in full motion, and the department occupied by the wool industry exposition, was completely filled. Notwithstanding the great distance of the place of exhibition from the business center of the city, the attractions presented were so novel and numerous, that large crowds were drawn to it, during every day and evening, until its close. Every department of the exhibition, under the direct control of the Managers, contained many articles of unusual merit.

It would be impossible to enumerate them within the limits of an ordinary report, yet it will not be deemed invidious or improper to state that an unusually rich and surprising display of raw and manufactured silks was made, and that for it, the Institute is indebted to the prompt action of the American Association of Silk Manufacturers, and particularly to the personal exertions of Mr. Frederick Baare.

The exposition of the wool industry, under the immediate direction of the National Association of Wool Manufacturers, contained the largest and richest collections of woolen fabrics ever shown in this country, and, as it furnished a reliable indication of the extent of this branch of domestic manufactures, it excited unusual surprise and interest.

The Managers take this opportunity to express their thanks to the judges who officiated in the seven departments of the regular exhibition. Their duties were arduous, but they were performed with commendable zeal and impartiality, and the results of their labors will be seen in the following enumeration of awards which have been made in accordance with their decisions.

	1st Medal.	2d Medal.	3d Medal.
I. Department of Fine Arts and education......	26	19	4
II. Department of the Dwelling	31	53	61
III. Department of Dress and Handicraft........	29	35	8
IV. Department of Chemistry and Mineralogy ...	24	22	11
V. Department of Engines and Machinery	76	92	47
VI. Department of Intercommunication	19	35	52
VII. Department of Agriculture and Horticulture.	27	24	5
Total of each medal	232	280	188

Total of all medals..................................	700
The number awarded at exhibition of 1867 was.............	522
Excess in 1869	178

In addition to these, the Board has awarded, for the first time in the history of the Institute, the large medal of honor, authorized by article ten, section thirteen, of the by-laws, for Lyall's positive motion power loom, which obviates the throwing of the shuttle, a plan used in the art of weaving for more than four thousand years, and which until lately was supposed to be indispensable.

One of the striking features of this exhibition was the series of addresses delivered by gentlemen widely known for the interest they have taken in the progress of the industrial arts. The first was made at the opening by the President of the Institute, who appropriately welcomed both exhibitors and visitors. The second was by the Hon. S. S. Fisher, of Washington, Commissioner of Patents, who gave an able review of the triumphs of American inventions and the prominent part which the American Institute had taken in fostering that creative genius which aims to produce the useful rather than the beautiful, and which has given us labor-saving machines and all those improvements that tend to alleviate the material condition of man. The third was by Dr. George B. Loring, of Salem, Mass., who advocated in eloquent terms the agricultural interests of the country. The fourth was by Mr. Erastus Bigelow, the well known inventor

and President of the National Association of Wool Manufacturers, who pointed out the true course to be pursued for the encouragement of the production of wool and for its conversion into useful fabrics. The fifth was by the Rev. Dr. Barnard, President of Columbia College and United States Commissioner at the International Exposition of 1867 held at Paris, who gave an interesting account of the novelties he saw at that exposition, and who gratified his auditors by the statement that although the display in the American department was not large, it contained a majority of the most useful and ingenious inventions, and attracted more attention from Europeans than any other part of the exposition. The sixth was by Britton Richardson, Esq., who gave an unexpectedly favorable report of the progress of the silk industry in the United States, and furnished abundant proof that, with proper encouragement, it will yet be able to supply the home demand for silk goods. The last two addresses were made by the President of the Institute and the Chairman of the Board, on the closing night, before the reading of the awards. They expressed in glowing words the congratulations of the Board at the complete success of the thirty-eighth exhibition.

The receipts and expenditures of the exhibition have been as follows:

RECEIPTS.

From treasurer of the American Institute, appropriated,		$1,000 00
Total receipts at the doors, including season, mechanics and school tickets...	$53,234 37	
Entry fees..........................	2,263 00	
Stands, privileges, restaurant, catalogue, &c..............................	3,285 00	
Exhibitor's pullies....................	524 24	
Exhibitor's extra gas consumed	144 25	
Third and Second avenue railroads	666 66	
Sales of sundries....................	48 00	
		60,165 52
Amount to be accounted for..........................		$61,165 52

EXPENDITURES.

Committee on Location.

Rent of building...........	$6,000 00		
Ground rent of lots	100 00		
Insurance on building and property................	1,183 75		
		$7,283 75	
Carried forward..................		$7,283 75	$61,165 52

Brought forward		$7,283 75	$61,165 52
Committee on Building and Carpenter's work.			
Buildings and architects plan	$4,653 16		
Lumber	1,177 60		
Carpenter's work and making tables	1,028 58		
		6,859 34	
Committee on Printing and Invitations.			
Printing blanks, circulars, posters, tickets, stamps, &c.	$1,974 55		
Advertising	4,061 06		
Agent	565 00		
		6,600 61	
Committee on Machinery.			
Shafting, hangers, steam pipes, &c.	$3,979 50		
Fuel	1,795 28		
Pay rolls, engineers, laborers, &c	1,061 82		
Belting blocks and falls, oil, cartage, &c	270 47		
		7,107 07	
Committee on Police, Light, Music and Decorations.			
Police and watchmen	$872 06		
Light	4,225 30		
Music	3,189 02		
Decorations	471 83		
		8,758 21	
General expense.			
Superintendent	$1,040 00		
Clerks in Secretary's office	561 00		
Floor clerks	1,113 00		
Laborers	2,103 63		
		4,817 63	
Committee on Finance.			
Ticket sellers		338 00	
Committee on Tickets.			
Ticket receivers and door keepers		418 50	
Carried forward		$42,183 11	$61,165 52

Brought forward		$42,183 11	$61,165 52
Committee on Stands and Refreshments.			
Refreshments for managers, judges and guests, including ice	$1,364 43		
Putting up range in restaurant	40 50		
		1,404 93	
Miscellaneous.			
Hardware, cartage, badges and sundries		1,193 78	
Premiums.			
Paid bills on this account		262 74	
			45,044 56
			$16,120 96
By cash, Treasurer American Institute, amount advanced		$1,000 00	
" Estimated surplus		15,000 00	
			16,000 00
Balance on hand February 1, 1870			$120 96

At a regular meeting of the Institute, held October 7th, 1869, a communication was received from the Board of Managers, stating that they considered it expedient to hold a fair next year, because a large expenditure had been incurred in constructing buildings and all the necessary attachments thereto, and in providing expensive appliances used in the department of engines and machinery, which could be made available at such a fair. Thereupon it was unanimously resolved, that the present Board of Managers have discretionary power to make all preliminary arrangements for the annual exhibition of 1870. In obedience to this resolution, the Board obtained a lease of the premises belonging to the Empire skating rink, for the months of September and October, 1870, and decided to purchase the large building erected for them, which was offered by its owner for the sum of $200 less than that stated in the original agreement. They also decided to preserve, for their successors, all the articles which could be used at the next exhibition.

The following is an account of the cost of such property:

Building for machinery	$3,800 00
Shafting, hangers, &c	2,242 88
Tables, lumber and sundries	700 00
Water and gas pipes	500 00
Carried forward	$7,242 88

Brought forward	$7,242 88
Gas-light reflectors	150 00
To this must be added the amount paid for insuring the above named property	228 75
And for printing applications for space at the exhibition of 1870	95 00
	$7,716 63

The financial statement shows that the Managers have paid into the treasury of the Institute	$15,000 00
And that they have a balance of	120 96
Making	$15,120 96
From this should be deducted the estimated cost of medals, engravings, diplomas and penmanship thereon	1,000 00
Leaving	$14,120 96
To this sum should be added the amount drawn from the present exhibition, to pay for property to be used in the next, as already detailed	7,716 63
Making a total of	$21,837 59

There was also received from 296 candidates for membership	$1,825 00
And from members for arrears of dues	1,320 00
	$3,145 00

A large proportion of which would not have been received, if an exhibition had not been held. A detailed account of the receipts and expenditures made by the Board, which have been submitted with the vouchers to the Finance Committee, in accordance with article ten, section twenty-two of the by-laws.

ORESTES CLEVELAND.	THOMAS RUTTER.
WILLIAM H. BUTLER.	THOMAS HICKS.
THOMAS McELRATH.	SAMUEL D. TILLMAN.
J. GROSHON HERRIOT.	SAMUEL R. WELLS.
CHAS. WAGER HULL.	EDWARD RICHMOND.
NATHAN C. ELY.	WILLIAM E. PEARSE.
WM. S. CARPENTER.	JOSEPH B. LYMAN.
GEORGE TIMPSON.	WALTER SHRIVER.
CHARLES K. HAWKES.	J. V. C. SMITH.
JAMES KNIGHT.	J. TRUMBULL SMITH.

NEW YORK, *February 3d*, 1870.

PREMIUMS

AWARDED AT THE THIRTY-EIGHTH ANNUAL EXHIBITION, 1869.

I.—DEPARTMENT OF FINE ARTS AND EDUCATION.

FIRST GROUP.—Paintings on canvas, glass and other surfaces; pastels, cartoons, miniatures.

SECOND GROUP.—Engravings, lithographs, chromo-lithographs, chemical etchings, plain and colored, enamel work, designs and drawings relating to architecture, landscape gardening, mechanical and civil engineering.

THIRD GROUP.—Photographs, plain and colored, daguerreotypes, ambrotypes; all other impressions by the action of light.

FOURTH GROUP.—Sculpture, cameos, intaglios, medals, medallions, reliefs, embossed work, fine castings in bronze, zinc, and other metals.

FIFTH GROUP.—Musical instruments—pianos, harps, organs, melodeons, portable instruments used in bands and concerts.

SIXTH GROUP.—Specimens of printing and bookbinding, books, stationery, ornamental penmanship, globes, maps, charts, and all apparatus for instructing in science, tables and machines for calculation.

SEVENTH GROUP.—Philosophical instruments, mathematical and measuring instruments, dials, chronometers, watches and clocks, telescopes, microscopes, lenses, cameras, and other optical instruments, including stereoscopes, spectacles and opera glasses.

DEPARTMENT I.—GROUPS 1, 2, 3 AND 4.

Judges—Messrs. GEORGE A. BAKER, LAUNT THOMPSON, AUGUSTUS WETMORE.

O. J. Lay, 235 East Thirty-first street, New York, for an oil painting, "After the Storm." First medal and diploma.

G. W. Smith, 363 Broadway, New York, for a pen and ink drawing, copy of an engraving. Second medal and diploma.

Edward Sears, 48 Beekman street, New York, for specimens of wood engraving. Second medal and diploma.

Charles Sears, 66 and 68 Fulton street, New York, for specimens of wood engraving. Second medal and diploma.

N. Poulson, 111 Third avenue, New York, for mechanical and architectural designs. Second medal and diploma.

L. Prang & Co., Boston, Mass., for chromo-lithographs. First medal and diploma.

W. Kurtz, 872 Broadway, New York, for a collection of photographic portraits in color and India ink. First medal and diploma.

Charles Bierstadt, Niagara Falls, N. Y., for plain stereoscopic views. First medal and diploma.

G. G. Rockwood, 839 Broadway, New York, for large size out-door plain photographs. First medal and diploma.

H. M. Coffee, 156 Fourth avenue, New York, for plaster casts from the antique. First medal and diploma.

John Matthews, Seventy-fifth street, New York, for an electrotype antique vase deposited in metallic moulds by the electro process (galvano-plastic), a praiseworthy reproduction. First medal and diploma.

E. Plassman, 95 Sixth avenue, New York, for a carving in black walnut, "Plover, with young," of a high order of merit and a superior work of its kind. Second medal and diploma.

S. N. Carvalho, 765 Broadway, New York, for large size Ferreotypes. First medal and diploma.

S. A. Holmes, 575 Broadway New York, for large plain photographs of cattle and out-door work. Second medal and diploma.

Henry Merz, 183 Essex street, New York, for plain photographic compositions. Second medal and diploma.

Peter F. Weil, 643 Broadway, New York, for stereoscopic views. Second medal and diploma.

L. A. Lanthier, 744 Broadway, New York, for passe-partouts, artistic in design and execution. First medal and diploma.

Alexander Becker, 560 Broadway, New York, for a revolving stereoscope and stand. First medal and diploma.

Henry Morton,* Franklin Institute, Philadelphia, Penn., for photographic views of the great Solar Eclipse. First medal and diploma.

Department I.—Group 5.

Judges—Messrs. H. J. Newton and James W. Pirsson.

H. L. Roosevelt, 849 Broadway, New York, for an electrical attachment to organs. First medal and diploma.

Hallet, Davis & Co., 787 and 789 Broadway, New York, for a grand and square piano. First medal and diploma.

Schuetze & Co., 452 Broome street, New York, for a square piano. Second medal and diploma.

J. C. Barnes, 137 Eighth street, New York, for a square piano. Third medal and certificate.

C. E. McDonald, 215 East Twenty-sixth street, New York, for a square piano and prop stick. Second medal and diploma.

A. Wunderman, 627 Broadway, New York, for a square piano. Third medal and diploma.

J. W. Tanner, 218 East Twenty-first street, New York, for improved combination fifes. First medal and diploma.

L. Schreiber, 22 Wooster street, New York, for Schreiber's cornets. First medal and diploma.

Wm. Hall & Son, 543 Broadway, New York, for specimens of flutes. First medal and diploma.

Department I.—Group 6.

Judges—Messrs. John B. Rich, Hugh Foulke, Francis P. Schoals.

Francis & Loutrel, 45 Maiden lane, New York, for the best blank books. Mr. Loutrel being a trustee of the Institute, the firm are debarred from receiving a premium.

* Reported on by the judges at large.

J. Schedler, Hudson City, N. J., for a collection of terrestrial globes. Second medal and diploma.

Henry Whitall, 512 Arch street, Philadelphia, Pa., for movable planispheres. First medal and diploma.

Rev. J. Davis, Pittsburg, Pa., for the heliotellus. First medal and diploma.

M. Long, 224 East Seventy-ninth street, New York, for the tellerian. First medal and diploma.

H. Williamson, 118 East Eighty-third street, New York, for concentric, celestial and terrestrial globes. Second medal and diploma.

C. B. Boyle, 839 Broadway, New York, for a model of the moon. First medal and diploma.

Charles H. Webb, 713 Broadway, New York, for an adding machine. Second medal and diploma.

Haskins & Cammeyer, 36 Beekman street, New York, for document envelops. Second medal and diploma.

D. Webster Clegg, 38 Cortlandt street, New York, for the patent concave combination ruler and paper cutter. Third medal and certificate.

Keuffel & Esser, 71 Nassau street, New York, for hard rubber T squares and patterns for angles and curves. Third medal and certificate.

DEPARTMENT I.—GROUP 7.

Judges—Messrs. JOHN B. RICH, HUGH FOULKE, RICHARD KEEPING.

S. A. Kennedy, 482 Broadway, New York, for an electric clock. Second medal and diploma.

L. Bradley, Jersey City, N. J., for a system of electric time keeping. First medal and diploma.

United States Clock Company, 18 Cortlandt street, New York, for a regulator with twenty-four dials. Second medal and diploma.

A. S. Hotchkiss & Co., 3 Cortlandt street, New York, for a tower striking clock. First medal and diploma.

Albert Endweiss, 211 Division street, corner Clinton, for a skeleton time piece. First medal and diploma.

A. Bronson, 127 Elm street, New York, for a drawing protractor T and bevel square. Second medal and diploma.

W. H. Paine, Greenpoint, L. I., for a surveying and measuring apparatus. First medal and diploma.

Hamilton E. Towle, 176 Broadway, New York, for an ingenious and effective grade and draining level. Mr. Towle being a member of one of the standing committees of the Institute, was debarred from receiving a premium.

E. Weiskopf, 182 Centre street, New York, for a case of optical lenses. Second medal and diploma.

Willard Manufacturing Company, 684 Broadway, New York, for a case of photographic cameras. Second medal and diploma.

Edmund Blunt, 26 Burling slip, New York, for a case of optical instruments. First medal and diploma.

J. Bogardus, corner White and Elm streets, New York, for a bathometer for taking deep sea soundings. First medal and diploma.

The judges in department one, group seven, having reported that having no convenience for properly testing the philosophical instruments contained in entries No.

59, C. Storm, No. 295, C. Busch and No. 776, Columbo and Tagliabue, suggest that if the exhibitors desire it the Board of Managers will request the American Institute to appoint a special committee to examine, test and report upon the merits of the several instruments contained in these cases.

II.—DEPARTMENT OF THE DWELLING.

First Group.—Apparatus for warming, cooling and ventilating rooms; cooking stoves, ranges and refrigerators, water filters and coolers.

Apparatus for illumination, ornamental lamps, chandeliers and gas fixtures.

Second Group.—Kitchen ware and utensils; machines and implements for washing, wringing and drying clothes; mangles, ironing and fluting machines, etc.

Third Group.—Carpets, oil cloths, mattings, paper hangings and tapestry, window curtains, shades and screens.

Encaustic tiles, and specimens of ornamental flooring, fresco work, and ornamental plasterings.

Fourth Group.—Furniture—mirrors, upholstery, beds, bed springs, mattresses, and room conveniences. Secretaries and ornametal safes. Ladies toilets and work boxes.

Fifth Group.—Table furniture—cutlery, castors, glass, china, porcelain, silver and other ware used for holding food and condiments.

Sixth Group.—Ornaments for the dwelling-house, excepting those embraced in the first department.

Wax flowers and fruit, ornamental hair work and worsted embroidery and chrochet work.

Passe partout, picture frames and moulding, brackets, etc. Billiard tables, chessmen, draught and backgammon boards and tables; all other contrivances for in-door recreation and amusement.

Seventh Group.—Building accessories and permanent attachments; doors, window sash, blinds, matels, grates, stairs, timber frames, cut and cast ornaments for the outside of dwellings.

Hand pumps, plumbers' work, water closet apparatus and baths; bells, door springs, latches, bolts, sash fastenings and weights, hinges, screws, nails, and other household hardware.

Useful and ornamental articles for the grounds surrounding the dwellings.

Department II.—Group 1.

(*Part A.*)

Judges—Charles P. Russell, R. B. Coleman, John Abendroth.

D. H. Lowe, 480 Broadway, New York, for a vapor stove. First medal and diploma.

Andrew F. Barry, Fifty-ninth street and Third avenue, New York, for a house cooking range. First medal and diploma.

Hull, Grippen & Co., 310 and 312 Third avenue, New York, for a furnace. First medal and diploma.

A. L. Bogart, 702 Broadway, New York, for gas stoves. Second medal and diploma.

Burtis & Rice, 206 Water street, New York, for a portable heater. First medal and diploma.

Wm. C. Lesster, 266 West Thirty-sixth street, New York, for a fire-place heater. Second medal and diploma.

Excelsior Manufacturing Company, 581 Broadway, New York, for the Eureka coffee pot. First medal and diploma.

Novelty Boiler Company, Newark, N. J., for boilers for fish, meats, &c. First medal and diploma.

E. Moncuse & Duparquet, 28 and 30 Greene street, New York, for a double fire hotel range. First medal and diploma.

E. K. Sargeant, Boonton, N. J., for the alarm coffee pot. Third medal and certificate.

George Steffens, 18 Sandford street, Brooklyn, E. D., for a collection of sculptures. Third medal and certificate.

Alexander M. Lesley, 605 Sixth avenue, New York, for a zero refrigerator. Third medal and certificate.

A. Gerster, northeast corner Fifth avenue and Thirteenth street, Brooklyn, N. Y., for rustic settees. Second medal and diploma.

William J. Miller, 50½ South Sixth street, Brooklyn, L. I., for a case of gilt walnut frames. Third medal and certificate.

H. L. Speth, 47 Elizabeth street, New York, for walnut brackets. Third medal and certificate.

Ornamental Wood Company, Bridgeport, Conn., for ornamental wood. First medal and diploma.

Group 1—(*Part B*).

Judges—Messrs. Stephen Thorne, George Hathorne, John B. Paine.

Julius Ives & Co., 37 Barclay street, New York, for chandeliers, gas fixtures and kerosene lamps. Second medal and diploma.

A. Henkel & Co., 60 to 66 Cannon street, New York, for machine carving. First medal and diploma.

Petry, Bros. & Co., 283 Pearl street, New York, for side show-window reflectors. Third medal and certificate.

United States Improved Reflector Company, 449 Broadway, for silver plated reflectors. First medal and diploma.

Murphy & Cole, 81 Newark avenue, Jersey City, N. J., for perpetual lamp wick. Third medal and certificate.

Edward Knabeschuch,* 121 Greene street, New York, for superior specimens of ornamental turning. Second medal and diploma.

P. Mignot, 43 Wooster street, New York, for fancy brass articles. Third medal and certificate.

New York Natural Wood Printing Company, 543 and 545 West Twenty-first street, New York, for paper hangings. Second medal and diploma.

Votaw, Montgomery & Co., 19 Cortland street, for non-explosive kerosene lamps. Second medal and diploma.

J. F. Sandford, 40 John street, New York, for safety lamps for kerosene. Third medal and certificate.

Mitchell, Vance & Co., 597 Broadway, New York, for chandeliers, gas fixtures, bronze figures, church fixtures and emblems. First medal and diploma.

M. L. Curtis & Co., 3, 5 and 7 East Fourth street, New York, for chandeliers. Third medal and certificate.

* Reported on by the judges at large.

DEPARTMENT II.—GROUP 2.

Judges—GEORGE H. SARGENT, A. W. NEWCOMB, MARCUS C. HAWLEY.

Hamilton E. Smith, Twenty-eighth street and First avenue, New York, for a hydaulic power clothes washer and hydraulic clothes washer, hand power. First medal and diploma.

Mrs. E. D. Hunt, 107 West Thirty-sixth street, New York, for the spiral washing machine. Third medal and certificate.

Home Manufacturing Company, 13 Barclay street, New York, for the home washer and wringer. Third medal and diploma.

Hamilton E. Smith, Twenty-eighth street and First avenue, New York, for a rotary mangle. First medal and diploma.

J. F. Palmer, Auburn, N. Y., for the challenge wringer and mangler combined. Second medal and diploma.

R. H. Allen & Co., 191 Water street, New York, for a mangle. Third medal and certificate.

Putnam Manufacturing Company, 13 Platt street, New York, for a clothes wringer. Second medal and diploma.

Eureka Manufacturing Company, Boston, Mass., for the eureka clothes wringer. Third medal and certificate.

T. W. R. Rayner, 35 Cortlandt street, New York, for a steam clothes washer. Second medal and diploma.

Hyatt & Spencer, 54 Beckman street, New York, for the acme fluting machine. Second medal and diploma.

A. S. Bogart, 702 Broadway, for a fluting machine. Third medal and certificate.

S. W. & J. F. Palmer, Auburn, N. Y., for a power and hand washing machine. Second medal and diploma.

DEPARTMENT II.—GROUP 4.

Judges—Messrs. J. W. VANDEWATER, JAMES M. COPPERNOLL.

W. D. Gibson, 154 East Twenty-third street, New York, for a bedstead bookcase. Second medal and diploma.

Woven Wire Mattrass Company, Hartford, Conn., for the woven wire spring mattrass. First medal and diploma.

W. Scott, 35 and 37 Park Place, New York, for the diamond spring mattrass. Second medal and diploma.

Benjamin F. Smith, New Orleans, La., for a cane life-preserving spring bed bottom. Second medal and diploma.

G. W. Barnes & Son, 315½ Bowery, New York, for a spring bed bottom and cot. Second medal and diploma.

W. S. Pettit, 38 Cortlandt street, New York, for the eureka spring bed. Second medal and diploma.

J. E. Chapman & Co., 177 Grand street, New York, for the empire spring bed. Third medal and certificate.

S. P. Kittle, Newark, N. J., for spring mattress, under beds, blankets, quilts, counterpanes, pillows and bolsters. Second medal and diploma.

M. B. Wentworth, 81 East Broadway, New York, for an inlaid table. Third medal and certificate.

F. F. Russell & Co., Thirtieth street, corner First avenue, New York, for a lady's fancy work table. Second medal and diploma.

Lippincott & Co., 171 Canal street, New York, for a sofa bedstead. Second medal and diploma.

Julius Werner, 405 Fourth avenue, New York, for a sofa bedstead. Third medal and certificate.

M. K. Maximilian, 79 Third avenue, New York, for a sofa bedstead. Third medal and certificate.

F. R. Osgood, Grand Rapids, Mich., for an extension table. Second medal and diploma.

A. Henkel & Co., 60 to 66 Cannon street, New York, for a collection of fancy tables. Second medal and diploma.

Drouhard & Roye, 178 Prince street, New York, for a multiplying division parlor table. Third medal and certificate.

Hildebrand & Hertwig, 14 and 16 Amity place, New York, for a library secretary. Third medal and certificate.

A. K. McMurray, Buffalo, N. Y., for rocking chairs. Second medal and diploma.

D. Witt, Hubbardstown, Mass., for rocking chairs. Third medal and certificate.

Charles G. Schmidt, 426 Sixth avenue, New York, for folding chairs. Second medal and diploma.

Henry I. Seymour, West Troy, N. Y., for chairs. Second medal and diploma.

Alfred Hutchinson, 1611 North Second street, Philadelphia, Pa., for a school desk. Third medal end certificate.

Mrs. A. M. Rodgers, 63 St. Felix street, Brooklyn, N. Y., for improved mosquito nets. Third medal and certificate.

Joshua Monroe, 413 Canal street, New York, for portable berths. Second medal and diploma.

J. R. Harrington, Atlantic avenue, near Classon avenue, Brooklyn, N. Y., for carpet lining and stair pads. Second medal and diploma.

The Planet Mills, 144 Water street, New York, for oil cloth foundation. First medal and diploma.

R. d'Heureuse, 35 and 37 Park place, New York, for cord attachment, notch and angle. Third medal and certificate.

Department II.—Group 5.

Judges—Messrs. G. B. Germond, J. H. Frey, William H. Williams.

Reed & Barton, Taunton, Mass.; E. D. Bassford, Cooper building, exhibitor, for silver plated ware. First medal and diploma.

Holmes, Booth & Hayden, 27 Reade street, New York, for silver plated ware. First medal and diploma.

Simpson, Hall, Miller & Co., 19 John street, New York, for plated ware. Second medal and diploma.

Manning, Bowman & Co., 60 John street, New York, for silver plated ware. Third medal and certificate.

J. Adams, Boston, Mass.; L. L. Smith, agent, 6 Howard street, New York; for nickel plated ware. First medal and diploma.

Quinnell & Harris, 447 Broome street, New York; E. D. Bassford, Cooper building, exhibitor, for cut glass ware. First medal and diploma.

Thill & Wapler, 22 Warren street, New York, for glass ware. Second medal and diploma.

Union Porcelain Works, 15 Park place, New York, for American china ware. First medal and diploma.

American Papier Mache Company, 45 Murray street, New York, for papier mache goods. Third medal and certificate.

J. P. Taylor Manufacturing Company, Hudson City, N. J., for a bread and meat slicer. Third medal and certificate.

John Burgum, Concord, N. H., for a device for keeping meat under brine. Third medal and certificate.

The Mason Manufacturing Company, 9 Bedford street, New York, for fruit jars. Third medal and certificate.

J. H. Foote, 1287 Broadway, New York, for a patent dinner pail. Third medal and certificate.

N. Maurice & Co., 65 Murray street, New York, for pails. Third medal and certificate.

O'Brian Mop and Brush Holder Company, 14 Charlton street, New York, for a mop and brush holder. Third medal and certificate.

Taylor & Knight, Brasher Falls, N. J., for a carpet sweeper. Third medal and certificate.

New York Line Holder Company, 35 and 37 Park place, New York, for clothes line holders. Third medal and certificate.

D. A. Newton, 38 Cortlandt street, New York, for the American meat and vegetable chopper. Third medal and certificate.

D. E. Crosby, South Vineland, N. J., for a clothes horse and ironing board. Third medal and certificate.

Ben. Ryer & Sons, 58 and 60 Doughty street, Brooklyn, N. Y., for patent cast-iron bottom kettles. Third medal and certificate.

DEPARTMENT II.—GROUP 6.

Judges—Messrs. GEORGE B. MYER, THOMAS J. ATKINS, P. B. FRANKLIN.

Kavanagh & Decker, corner Canal and Center streets, New York, for improved cat-gut edge cushions for billiard tables. First medal and diploma.

Thill & Wapler, 22 Murray street, New York, for glass shades. Second medal and diploma.

S. J. Pardessus & Co., 9 and 11 Park Place, New York, for glass shades. Third medal and certificate.

Miss Mary Williams, 35 King street, New York, for worsted embroidery. Second medal and diploma.

Misses G. & J. Tagliabue, Mount Vernon, N. Y., for worsted work. Third medal and certificate.

Amelia Jackson, 78 Ludlow street, New York, for worsted embroidery. Third medal and certificate.

Mrs. Addison Bartlett, 922 Broadway, New York, for wax flowers. First medal and diploma.

Mrs. Park, 375 Atlantic street, Brooklyn, N. Y., for wax flowers. Second medal and diploma.

Mrs. D. Hayward, 13 East Thirty-third street, New York, for wax flowers. Third medal ond diploma.

C. T. Raynolds & Co., 106 and 108 Fulton street, New York, for wax flower materials. Second medal and diploma.

Mrs. C. L. Bockoven, 47 Parkhurst street, Newark, N. J., for hair wreath. Third medal and certificate.

Mrs. Job Cleveland, Jersey City, N. J., for hair work. Second medal and diploma.

A. H. Seaver, 76 Pearl street, New York, for a self-acting swing. Second medal and diploma.

H. F. Metzler, 33 Noble street, Greenpoint, L. I., for a self-acting swing. Third medal and certificate.

DEPARTMENT II.—GROUP 7.

(*Part A.*)

Judges—Messrs. F. C. CROSS, A. BELKNAP, PETER McCARTEE, JOHN H. GRAHAM.

Anthony Wanner, 93 Eighth street, New York, for iron beams for fire proof buildings. Second medal and diploma.

Sloan Blind Lock Company, 424 East Twenty-third street, New York, for the Sloan blind lock. First medal and diploma.

James T. Pratt, 53 Fulton street, Brooklyn, L. I., for tool chest. Second medal and diploma.

P. Miles, 55 Chambers street, New York, for double pointed tacks. Third medal and certificate.

N. Poulson, 111 Twelfth avenue, New York, for fire proof stairs and window blinds. Second medal and diploma.

Isaac V. Holmes, 745 East Twelfth street, New York, for metallic lathing for fire proof walls. Second medal and diploma.

Osborn Manufacturing Company, 109 Bleecker street, New York, for bird cages. Third medal and certificate.

Job Jobson & Son, 918 Myrtle avenue, Brooklyn, L. I., for gate and latch hinge. Third medal and certificate.

J. C. Rankin, Mount Vernon, N. Y., for a ventilating sash lock. Third medal and certificate.

American Glass Window Pulley Company, 56 Congress street, Boston, Mass., for glass window pulleys. Third medal and certificate.

Washington Iron Works, Newburgh, N. Y., for fire proof shutters. Second medal and diploma.

J. Benedict, 624 West Forty-sixth street, New York, for the best sash weights. Third medal and certificate.

National Anti-friction Metal Company, 160 Fulton street, New York, for hinges. Third medal and certificate.

American Spiral Spring Butt Company, 27 Park Row, New York, for double and single action door springs. First medal and diploma.

Henry Diston, Philadelphia, Pa., for double acting hinges. Second medal and diploma.

Wm. McFarland, 446 West Thirty-first street, New York, for a blind slat tenon. Third medal and certificate.

P. & F. Corbin, 55 Beekman street, New York, for bronze butts, etc. First medal and diploma.

Evans & Godley, 1 Barclay street, New York, for an ash and garbage box. Third medal and certificate.

Thomas Dillon,* 1009 Third avenue, New York, for specimens of graining on wood and glass. Second medal and diploma.

* Reported on by the judges at large.

Russell & Erwin Manufacturing Company, 45 Chambers street, New York, for bronze door knobs. First medal and diploma.

F. & L. Many & Marchall, 48 Warren street, New York, for hand silver plated butts. Second medal and diploma.

GROUP 7.—(*Part B*).

Judges—Messrs. S. GRAHAM, WILLIAM H. JENKINS, B. F. WHITE.

Philip Schaad, 142 Laurens street, New York, for marble mantels. First medal and diploma.

American Stair Rod Company, 163 William street, New York, for stair rods. Second medal and diploma.

M. Gould & Son, 96 Chambers street, New York, for stair rods. Third medal and certificate.

Alexander Stevenson, 378 East Seventy-fifth street, near First avenue, New York, for a fan carpet cleaning machine. Third medal and certificate.

George Haynes, 367 West Eleventh street, New York, for a metallic skylight and ventilator. Third medal and certificate.

J. G. Kappes, 614 East Eleventh street, New York, for mosaic floors of wood. Third medal and certificate.

Penrhyn Slate Company, 40 West Eighteenth street, New York, for wainscotings, mantels, table tops and tilings. Second medal and diploma.

J. & R. Lamb, 59 Carmine street, New York, for church decorations. Third medal and certificate.

Hussey & Whittemore, 35 and 37 Park place, New York, for portable wainscoting and flooring. Third medal and certificate.

Allen & Kimball, Pittsford, Vt., for paper doors, panels, &c. Third medal and certificate.

James Harrison, 377 Second avenue, New York, for illuminated signs. Third medal and certificate.

A. S. Dickinson, 38 Cortlandt street, New York, for drop shade fixtures. Second medal and diploma.

J. David, 10 St. Felix street, Brooklyn, N. Y., for window shade fixtures. Third medal and certificate.

New York Hydraulic Machine Company, 63 Crosby street, New York, for a watermeter. Third medal and certificate.

Steele & Co., 3 Park place, New York, for feather dusters. Second medal and diploma.

Charles F. Linscott, 11 Barclay street, New York, for patent adjustable frames for window shades. Second medal and diploma.

Green & Rusling, 208 Broadway, New York, for invisible weather strips. Third medal and certificate.

De Witt Stevens, Newark, N. J., for model of an ash sifter. Third medal and certificate.

Warren S. Barlow & Son, 18 Varick street, New York, for door and blind springs. Third medal and certificate.

E. B. Hungerford,* Corning, N. Y., for glass window blinds. Second medal and diploma.

* Reported on by the judges at large.

GROUP 7.—(*Part B*).

Judges—Messrs. THOMAS D. STETSON, H: M. RUGGLES, F. G. SPENCER.

R. R. Burchell, 285 Delancy street, for seal and other locks. Second medal and diploma.

Russell & Erwin Manufacturing Company, 45 Chambers street, for mortice locks and bolts for front doors. First medal and diploma.

E. Holmes, 7 Murray street, for burglar alarm telegraph. First medal and diploma.

S. Oppenheimer, Newark, N. J., for cottage door locks, Third medal and certificate.

Wm. H. Mott, Third avenue, between 127th and 128th street, New York, for Union refrigerator locks. Third medal and certificate.

GROUP 7. (*Part E.*)

Judges—Messrs. WM. H. WALBRIDGE and JOHN SHERMAN.

Henry C. Myer, East Orange, N. J., for plumbers' brass and plated ware. Second medal and diploma.

Alex. Higginbotham, 205 East Forty-seventh street, New York, for overflow and wash basins. Second medal and diploma.

Earth Closet Company, 597 Broadway, New York, for earth commodes. First medal and diploma.

W. S. Carr & Co., 106 Centre street, New York, for a monitor water closet. Second medal and diploma.

John Keane & Co., 617 Broadway, New York, for exacter and hydro-valve water closet. Third medal and certificate.

Hayden, Gere & Co., 84 Beekman street, for patent trap for washbowls and sinks. Third medal and certificate.

Colwell, Shaw & Willard Manufacturing Company, corner Eleventh avenue and West Twenty-seventh street, for plumbers' joint for tinned and other soft metal pipes. First medal and diploma.

John Benson, Yonkers, N. Y., for basin cock coupling. Third medal and certificate.

III.—DEPARTMENT OF DRESS AND HANDICRAFT.

FIRST GROUP.—Apparel for ladies—hats, bonnets, hair work, dresses, hose, boots and shoes, gloves, shawls, cloaks, mantillas, manufactured furs.

SECOND GROUP.—Apparel for gentlemen—hats, caps, wigs, toupees, etc., coats, vests, pantaloons, shoes, boots, gloves, over-shoes, cloaks, undergarments, furs.

THIRD GROUP.—Cloths of wool, cotton and silk; all other fabrics, woven, knit or felt, excepting carpets; ribbon, cord, tassels, thread, buttons, pins, and other materials used in combination with cloth for dresses.

FOURTH GROUP.—Hand implements used in manufacturing dress--sewing machines, knitting machines, needles, thimbles, scissors, pocket knives, razors, etc.

FIFTH GROUP.—Medical and surgical apparatus and instruments—trusses, artifical limbs, specimens of dentistry and dental instruments.

SIXTH GROUP.—Jewelry and ornaments for the person; attachments used in out-door sports—skates, fishing tackle, hunting and shooting apparatus; gymnastic implments, and toys for children.

Meerschaums and other smoking pipes. Cases for pipes and cigars.

SEVENTH GROUP.—Portable writing desks, port folios, pocket pens and pencils, pocket books.

Trunks, carpets bags, reticules, traveling cases, umbrellas, parasols, canes.
Hand implements not elsewhere enumerated.

DEPARTMENT III.—GROUPS 1 AND 2.

Judges—Messrs. STEPHEN HYATT, CHARLES BUCKINGHAM, Jr., JAMES L. TODD.

Mademoiselle O. Bousson, 491 and 860 Broadway, New York, for men's dress shirts and cushion lace. Second medal and diploma.

Hamilton E. Smith, 55 Hudson street, New York, for perforated buckskin under-garments. Second medal and diploma.

Lyon Brothers, 33 Cortlandt street, New York, for gloves, mitts and gauntlets of various kinds of leather. First medal and diploma.

North & Long, 326 Broadway, New York, for gloves and mitts of various kinds of leather. Second medal and diploma.

Seymour & Sharp, 233 West Twenty-ninth street, New York, for silk and cotton elastic suspenders with patent metallic ends, Second medal and diploma.

P. C. Moulton, New Haven, Conn., for patent bow retainer. Second medal and diploma.

John L. Watkins, 114 Fulton street, for boots and shoes of improved form. Second medal and diploma.

Johnson & Sibley, Auburndale, Mass., for horse hair inner soles for boots and shoes. Third medal and certificate.

New Haven Rubber Sole Company, New Haven, Conn., for rubber soles for boots and shoes. Second medal and diploma.

N. McCollum, 19 Spruce street, New York, for fancy shoe findings and trimmings. Second medal and diploma.

Barnes & Cruttenden, 335 Broadway, New York, for corset steel. Third medal and certificate.

Wilson & Hoyt, 633 Broadway, New York, for patent necktie fastener and buttoner. Third medal and certificate.

J. C. Merritt, West Point, N. Y., for shoulder strap fastening. Third medal and certificate.

L. Binns, 577 Broadway, for ladies' bonnets and hats. Third medal and certificate.

Balch, Price & Co., 185 Fulton street, Brooklyn, N. Y., for manufactured furs, a large and valuable assortment. First medal and diploma.

William H. White, Kent Island, Md., for men's silk and fur hats. Second medal and diploma.

John R. Terry, 19 Union square, for ladies' and men's hats and furs. Third medal and certificate.

DEPARTMENT III.—GROUP 3.

Judges—JAMES H. SACKETT, THOMAS VARKER, CHARLES BUCKINGHAM, Jr., SAMUEL WEBBER.

Nonotuck Silk Company, Florence, Mass., for bleached and colored sewing silk, machine twist and sewing in the gum. First medal and diploma.

Bernstein & Mack, 479 Broadway, New York, for silk chenille of fine quality and colors. Second medal and diploma.

P. G. Givernaud, Hoboken, N. J., Benhard & Hutton, agents, 144 Duane street, New York, for plain black and colored silk dress goods. First medal and diploma.

Cheney Brothers, Hartford, Conn., for fancy striped silk, and silk and worsted poplins. First medal and diploma.

Dale Manufacturing Company, Paterson, N. J., for silk serges, scarfs and braids. First medal and diploma.

W. H. Horstmann & Sons, Philadelphia, Pa., for silk, silk and cotton trimmings, fringes, tassels and navy belts. First medal and diploma.

James S. Shapter, Paterson, N. J., for silk serges, black satin, cotton filling, dress silks, reps, &c. Second medal and diploma.

Frederick Baare, Schoharie, N. Y., for silk and wool poplins. Second medal and diploma.

Hamil & Booth, Paterson, N. J., for organzines twisted in the gum, machine twist and embroidery silks. First medal and diploma.

W. G. Watson & Son, Paterson, N. J., for black and colored sewing silk, machine twist, &c., canton in gum, black and colored. Second medal and diploma.

Oneida Community, Oneida, N. Y., for ribbons and machine twist. First medal and diploma.

Werner, Itschner & Co , Philadelphia, Pa., for fancy striped silk ribbons and black silk cravat. Second medal and diploma.

Cantrell & Chapin, Cresskill, N. J., for machine twist. Second medal and diploma.

George Comings, 29 Howard street, New York, for mohair and silk tassels and silk trimmings. First medal and diploma.

Excelsior Manufacturing Company, 92 Church street, for sewing silk in the skein and on spools, and machine twist. First medal and diploma.

Nottingham Manufacturing Company, A. G. Jennings, agent, 49 Barclay street, New York, for silk nettings, crochet, webbing, silks, hand nets, silk lace and silk buttons. Second medal and diploma.

C. W. Crosby, 935 Broadway, New York, for silk fringes. Second medal and diploma.

Palmer & Kendall, 158 Chambers street, New York, for shade fixtures, self-adjusting pulley, window lines, picture shades, bell and railroad rope. Second medal and diploma.

Hampden Mills, Holyoke, Mass., for ginghams, large assortment of patterns and colors. First medal and diploma.

James Y. Smith Manufacturing Company, Providence, R. I., for bleached sheetings and bleached shirtings with linen finish. First medal and diploma.

Davol Mills, Fall River, Mass., Low, Harriman & Co., agents, for bleached shirtings, pillow muslin, bleached, colored and black silesias. Second medal and diploma.

Wm Simpson & Sons, Philadelphia, Pa., for three-quarters cambric prints. First medal and diploma.

Greene & Daniels, Pawtucket, R. I., for ivory finished and six cord spool cotton, in white and colored. First medal and diploma.

Boston Elastic Fabric Company, 80 Franklin street, New York, for vulcanized rubber in sheets, and vulcanized rubber cut for warps. First medal and diploma.

DEPARTMENT III.—GROUP 4.

Judges—Messrs. THOMAS J. SLOAN, HENRY W. STEELE.

Weed Sewing Machine Company, 613 Broadway, New York, for the best family sewing machine. First medal and diploma.

Alben Warth, Stapleton, Staten Island, N. Y., for the best manufacturing sewing machine. First medal and diploma.

Empire Sewing Machine Company, 294 Bowery, New York, for a desirable sewing machine. Second medal and diploma.

Wagener Manufacturing Company, 825 Broadway, for a good family sewing machine. Second medal and diploma.

Greenleaf Stackpole, 21 Cortlandt street, New York, for an ingenious machine for sewing brooms. First medal and diploma.

Benedict Manufacturing Company, 636 Broadway, New York, for a noiseless feed for sewing machines. Second medal and diploma.

Morehouse & Heath, Hartford, Conn., for the best plaiter for sewing machines. First medal and diploma.

Isaac W. Barnum, 636 Broadway, New York, for a tucker and creaser. Second medal and diploma.

B. F. Ryder, 301 West Thirty-ninth street, for sewing machine castors. Third medal and certificate.

Hinkley Knitting Machine Company, 176 Broadway, for a simple and ingenious knitting machine. First medal and diploma.

Albert Komp, 47 Mercer street, New York, for a simple eyeletting machine. Second medal and diploma.

Henry Seymour & Co.,* 52 Beekman street, for superior shears, scissors, &c. First medal and diploma.

DEPARTMENT III.—GROUP 5—(*Part I*).

Judges—Messrs. LEWIS A. SAYRE, M. D., JAMES R. MCGREGOR, M. D.

A. A. Marks, 575 Broadway, for artificial limbs. First medal and diploma.

Monroe & Gardiner, 413 Canal street, New York, for artificial limbs. Second medal and diploma.

Thomas McIlroy, 145 Perry street, New York, for surgical operating table and oculists' operating table. First medal and diploma.

Crandall & Son, 470 Grand st., New York, for crutches. Second medal and diploma.

W. Pomeroy & Co., 553 Broadway, New York, for patent adjustable trusses. First medal and diploma.

W. Pomeroy & Co., 553 Broadway, New York, for splints for fracture of the clavicle and humerus. Second medal and diploma.

D. H. Goodwillie, 160 West Thirty-fourth street, New York, for an inhaling apparatus. Second medal and diploma.

GROUP 5—(*Part II*).

Judges—Messrs. JOHN B. RICH, S. A. MAIN, E. C. RUSHMORE.

S. S. White, Philadelphia, Pa., for an improvement in artificial teeth by the insertion of the foot-shaped pin. First medal and diploma.

S. S. White, Philadelphia, Pa., for superior dental instruments. First medal and diploma.

Guiseppe Tagliabue, 302 Pearl street, New York, for fine specimens of opera glasses. Second medal and diploma.

DEPARTMENT III.—GROUP 6.

Judges—Messrs. WILLIAM L. HULL, NATHAN L. ELY RICHARD E. SMITH.

J. S. Birch, 8 John street, New York, for self-adjusting watch keys. First medal and diploma.

* Reported on by the judges at large.

M. List, 599 Broadway, for the best carved meerschaum pipes and holders. Second medal and diploma.

F. J. Kaldenberg, 6 John street, New York, for the largest variety and best general display of meerschaum pipes and holders. Second medal and diploma.

F. Catlin, 1491 Broadway, New York, for patent safety pins. Second medal and diploma.

J. H. Morrow, 629 Broadway, New York, for microscopic charms and views, of very fine workmanship. Second medal and diploma.

F. R. Kaldenberg, Jr., 6 John street, New York, for meerschaum pipes. Third medal and certificate.

DEPARTMENT III.—GROUP 7.

Judges—Messrs. JOHN CATTRACH, JOHN SEAMAN, GEORGE WORTHINGTON.

Crouch & Fitzgerald, 1 Maiden Lane, New York, for the "Ristori" truck and shawl strap. Second medal and diploma.

Joseph C. Gillmore, 26 Fourth avenue, New York, for House's patent trunk shield. Second medal and diploma.

E. Scheel, 13 Park Place, New York, for fancy leather goods. First medal and diploma.

IV.—DEPARTMENT OF CHEMISTRY AND MINERALOGY.

FIRST GROUP.—Soaps, and all compounds for cleansing; toilet preparations, containing no deleterious ingredient.

Candles, oils, wax, resins, hydro-carbon compounds, and other natural or artificial products used for illuminating purposes.

SECOND GROUP.—Acids, alkalies, other chemical bases; salts, artificial fertilizers.

Soda water and apparatus for making it; mineral waters; wines, beverages and stimulants; tobacco, cigars and snuff.

Drugs, medicines, tinctures and extracts of officinal or known composition. Disinfectants and deodorizers; chemicals not elsewhere provided for.

THIRD GROUP.—Leather, skins, peltry, furs, parchments, specimens of taxidermy, catgut, goldbeaters' skins, membrane preparations; preserved wood, fiber, leaves and other natural products used in the arts.

FOURTH GROUP.—India rubber and gutta percha preparations, papier mache.

Artificial stone, brick, specimens of pottery, earthen ware, porcelain, china and glass.

Crucibles, cements, prepared materials for roofing.

FIFTH GROUP.—Paints, dye-stuffs, inks, specimens of dyed yarns, tissues, and other colored substances, and specimens of bleching.

Preparations for staining, cleaning and polishing; varnishes, blueing, blacking.

SIXTH GROUP.—Flour, meal, and other prepared products used as food.

Samples of baking and pastry cooking, sugars, confectionery, chocolate, cocoa; prepared condiments; preserved fruits, vegetables and meats; condensed fluids; extracts used in preparing beverages.

SEVENTH GROUP.—Specimens of natural stones used in buildings; minerals, ores, metals, alloys.

Modles of apparatus and implements used in chemical works and the laboratory.

Apparatus for making gas; machines for expediting chemicals changes.

Department IV.—Group 1 and 2.

Judges—Prof. George F. Barker, Prof. J. G. Pohle, Alexander Tripple.

J. C. Hull's Son, 32 Park Row, New York, for the best toilet soap. (Mr. Hull being a manager, no premium could be awarded, in accordance with the report of the judges.)

C. E. Griswold & Co., 38 Park Place, New York, for sonsy toilet soap. Second medal and diploma.

E. Morgan's Sons, 211 Washington street, New York, for sapolio. First medal and diploma.

Charles Pratt, 108 Fulton street, New York, for Pratt's astral oil. First medal and diploma.

Oliver & Harris, 582 Hudson street, New York, for whiskies. Second medal and diploma.

Geo. F. Gantz & Co., 136 and 138 Cedar street, New York, for lemon sugar and cream of tartar. Second medal and diploma.

Patterson & Brazeau, 297 Seventh avenue, New York, for salts for making mineral waters. First medal and diploma.

John Matthews, 447 and 449 First avenue, New York, for apparatus for making soda and aerated beverages; for apparatus for filling and corking bottles with liquids under pressure; for apparatus for filling and closing bottles without corks for still or sparkling liquids; for apparatus for making pure soda water, mineral waters, &c., furnishing the waters dispensed at the exhibition; for automatic machine for filling syphon bottles with safety screen to prevent accidents; for apparatus for cooling and dispensing mineral waters, soda water and syrup; for gravitating bottle stopper, and bottles for closing and containing still and sparkling liquids; for metallic encased glass fountains for mineral waters; for mineral and soda waters, simple and with syrups, as made and dispensed at this exhibition. For the above, as a whole, first medal and diploma.

Urbana Wine Company, Hammondsport, N. Y., for sparkling wine and brandy. Third medal and certificate.

H. A. Chalvin, 131 Fulton street, New York, for cordials. First medal and diploma.

William Gee, corner of Elm and Franklin streets, New York, for soda and bottling apparatus. Second medal and diploma.

Department IV.—Groups 3 and 4.

Judges—Messrs. George W. Blunt, John M. Masterton, William L. Hull.

Rutter & Simmons, 8 Perry street, for morocco, fancy colors. First medal and diploma.

Elihu Dwight, 21 Mercer street, New York, for japanned skins. Second medal and diploma.

New York Stone Works, for artificial stone. Second medal and diploma.

Hermann Gunther, Eightieth street, between Third and Fourth avenues, for artificial stone. Third medal and certificate.

James Judge, 119 East Fifty-third street, New York, for composition cement. First medal and diploma.

Union Paste Company, 20 Pell street, New York, for union and cement paste. Second medal and diploma.

S. Rapp, 75 Fulton street, New York, for tobacco. Second medal and diploma.

M. R. Pearsall, 192 Pearl street, New York, for segars. Second medal and diploma.

DEPARTMENT IV.—GROUP 5.

Judges—Prof. GEORGE F. BARKER, Prof. J. G. POHLE AND ALEX. TRIPPEL.

Tarr & Wonson, Gloucester, Mass., J. C. Griffing, agent, 44 Water street, New York, for copper marine paint. First medal and diploma.

J. H. Tiemann & Co., 165 Chambers street, New York, for liquid laundry blueing. Second medal and diploma.

Empire Ironclad Paint Company, 74 Maiden lane, New York, for ironclad paint. Second medal and diploma.

Lehigh Metallic Paint Company, 165 Pearl street, New York, R. D. Sharp, agent, for Lehigh metallic paint. Third medal and certificate.

Crampton Bros., 84 Front street, New York, for American sumach and quercitron. First medal and diploma.

J. P. Dinsmore, 36 Dey street, New York, for Carter's combined writing and copying ink. First medal and diploma.

G. de Cardova, 62 William street, New York, for annattoine. First medal and diploma.

F. W. Devoe & Co., 117 Fulton street, New York, for colors, dry and in oil, and varnishes. Second medal and diploma.

G. J. Hardy, 172 Clinton street, Brooklyn, N. Y., for Egyptian disinfectant powders. Second medal and diploma.

American Manufacturing Company, 12 Dey street, New York, for phœnix disinfectant. Third medal and certificate.

Elisha Crowell, 42 Water street, New York, for prepared codfish. An excellent and desirable article of food. First medal and diploma.

Charles Drake, 3 Hudson street, New York, for Ramsay's fruit jar. A very simple, cheap and efficacious jar. First medal and diploma.

Ryberg, Peckham & Co., 264 Division street, New York, for bottled soda water. Third medal and cetificate.

DEPARTMENT IV.—GROUP 6.

Judges—Prof. GEORGE F. BARKER, Prof. J. G. POHLE, THOS. S. OLLIVE, Dr. ADOLPH OTT.

E. N. Horsford, Cambridge, Mass., for Rumford's yeast powder. First medal and diploma.

Royal Baking Powder Company, 60 Vesey street, New York, for royal baking powders. Second medal and diploma.

C. Gulden & Co., 65 Elizabeth street, New York, for mustard. Second medal and diploma.

C. Boese & Co., 191 and 193 Christie street, New York, for prepared mustard. Third medal and certificate.

E. S. Baker, 52 Cannon street, New York, for Young America hams. Second medal and diploma.

New York Desiccating Company, 65 Murray street, New York, for desiccated cocoanut. Delicious taste and carefully prepared. Second medal and diploma.

Hecker & Brother, 201 Cherry street, New York, for flour, farina and self-raising flour. First medal and diploma.

Peter Cooper, 17 Burling slip, for gelatine. First medal and diploma.

Adolphus Glanz, 194 William street, New York, for Liebig extract of meat. Second medal and diploma.

Group 7.

Judges—Prof. George F. Barker, Prof. J. G. Pohle, Alexander Trippel.

John Matthews, 447 and 449 First avenue, New York, for warwick marble. Second medal and diploma.

Leocadia Marble Company, 54 Wall street New York, for leocadia marble. Third medal and certificate.

L. & J. W. Feuchtwanger, 55 Cedar street, New York, for manganese ore. Third medal and certificate.

R. C. Morton, Newark, N. J., for an ore separator. First medal and diploma.

S. R. Krom, 210 Eldridge street, New York, for an ore separator. First medal and diploma.

C. P. Morse, Rhinebeck, N. Y., for tubular cast-steel. First medal and diploma.

Herman Kohlbusch, Hudson City, N. J., for prescription scales. Second medal and diploma.

H. W. Butterworth, Philadelphia, Pa., for tinned sheet-iron. First medal and diploma.

Dixon Manufacturing Company, Jersey City, N. J., for stove polish. This is the best known; but owing to the manufacturer being one of the managers, no award can be made.

Glamorgan Soap Company, 45 Broadway, New York, for Fuller's soap. Third medal and certificate.

Andrew Kennedy, White Plains, N. Y., for peat. Third medal and certificate.

Chester Emery Company, Chester, Mass., for emery. First medal and diploma.

George Hall, 237 East Forty-first street, New York, for oil stones. Second medal and diploma.

John Matthews, 447 and 449 First avenue, New York, for metal spinning. Second medal and diploma.

New York Steel Works, Eighteenth street and avenues A and B, for specimens of steel. First medal and diploma.

J. Tagliabue, Westchester, N. Y., for a petroleum oil tester. First medal and diploma.

Thill & Wapler, 22 Warren street, New York, for a glass retort. Third medal and certificate.

Cleveland F. Dunderdale, 90 Wall street, New York, for the Dunderdale gas machine. It is superior in illuminating capacity to ordinary coal gas, and it is in every way as reliable. Extract from judge's report. First medal and diploma.

V.—DEPARTMENT OF ENGINES AND MACHINERY.

First Group.—Stationary engines driven by steam, heated air and other gases, water engines and water wheels, and all other prime movers, boilers, steam superheaters, safety valves, steam indicators and governors, dynamometers, steam gauges, and other safety apparatus for boilers, or to be attached to engines.

Second Group.—Pumping machinery—steam fire engines in operation, and other engines and apparatus for moving fluids, air pumps, fan blowers, etc., pipes for conveying water and other fluids, valves, cocks, joints and other appliances used in connection therewith.

THIRD GROUP.—Machinery for working metals—lathes, planers, screw-cutting machinery, drills, shaping and slotting machines, emery wheels, and all tools and apparatus used in working metals.

FOURTH GROUP.—Machinery for working in wood—lathes, saws, planing machines, boring machines, machines for mortising and tenoning, carpenters' tools, and other tools and apparatus for working in wood.

FIFTH GROUP.—Machinery for preparing fibres and tissues, carders, pickers, etc., machinery and all appliances used in the manufacture of cloth, carpeting, etc., spinning frames, spoolers, looms, machinery used in printing.

SIXTH GROUP.—Machinery and tools used in the manufacture of leather, India rubber, papier mache, paper, porcelain, pottery, bricks, and materials used in the arts not elsewhere specified.

SEVENTH GROUP.—Machinery for grinding or crushing grain, paint, plumbago and other natural products, gearing, millwork, friction pullies and elements of machinery for varying speed or power, all tools used by artisans or in factories not otherwise provided for.

DEPARTMENT V.—GROUP 1—(*Part A*).

Judges—Messrs. THOMAS J. SLOAN, ROBERT WIER, HAMILTON E. TOWLE.

William H. Harris, Providence, R. I., for a steam engine (Corliss'). For the best results on net effective power shown at the trial, being from one to two per cent better than any other on competition, and for superiority of workmanship and general arrangement of valves and valve gearing. First medal and diploma.

Babcock, Wilcox & Co., 44 Cortlandt street, for a steam engine. For the most perfect automatic expansion valve gearing on exhibition. First medal and diploma.

A. K. Rider, 482 West Twenty-fourth street, New York, for a vertical engine. For a novel arrangement of expansion, valve gearing under the Rider patent, combined with general simplicity of design, economy of space, and durability of construction. Second medal and diploma.

William Baxter, Newark, N. J., for a portable steam engine. Novel arrangement of variable cut-off, compactness, economy of fuel. First medal and diploma.

C. H. Delamater, foot of West Thirteenth street, New York, for a steam engine (Rider's). For great simplicity of expansion, valve gearing as connected with governor. Second medal and diploma.

S. H. Roper, Boston, Mass., for a caloric engine. Simplest and best application of heated air, utilization of the gases produced in the furnace by combustion, and compactness and economy. First medal and diploma.

R. M. Gallaway, 83 East Fourth street, New York, for a steam and water engine. Second medal and diploma.

R. K. Huntoon, Boston, Mass., for a patent governor. Best for stationary engines. First medal and diploma.

T. C. Bell, Bellows Falls, Vt., for jack screws. First medal and diploma.

L. D. Parsons, Tremont, N. Y., for wind mills and pumps. Best application for pumping by wind power. Second medal and diploma.

T. R. Pickering, 346 West Eleventh street, New York, for steam engine regulators. Cheap and simple. Third medal and certificate.

Frank Douglass, Norwich, Conn., for globe valves and lubricators. First medal and diploma.

H. G. Ludlow, Troy, N. Y., for valves. For the best action for water stop valves. First medal and diploma.

Henry Burt, Newark, N. J., for globe valves. For facility of repairs. Second medal and diploma.

Jewell & Sons, Hartford, Conn., for Babcock's belt laces. Simple and good. Third medal and certificate.

Thomas S. Davis, Lancaster, Pa., for a piston valve and case. Second medal and diploma.

C. L. Frink, Rockville, Conn., for the best packing for flanges, valves, &c. First medal and diploma.

Charles B. Richards, Hartford, Conn., for a steam engine indicator. Elegant workmanship and perfection of design. First medal and diploma.

Charles A. Schieren, 92 Gold street, New York, for fine belting and thoroughly stretched leather. Second medal and diploma.

Heim & Zimmerman, 33 Ferry street, New York, for fine leather belting. Not riveted; secured only by cement. Second medal and diploma.

Hoyt Bros., 28 and 30 Gold street, New York, for the best display of leather belting. Second medal and diploma.

P. H. Coyle, Newark, N. J., for patent steel flue brushes. First medal and diploma.

Department V.—Group 1—(*Part B*).

Judges—Messrs. Thomas J. Sloan, Robert Wier, Hamilton E. Towle.

James Harrison, Jr., Philadelphia, Pa., for the Harrison steam boiler. First medal and diploma.

John B. Root, 97 Liberty street, New York, for Root's wrought iron sectional boiler. Second medal and diploma.

Judges—Messrs. Nelson H. Barbour, J. K. Fisher, E. T. Ramsay.

Nelson, Finkel & Co., 439 East Tenth street, New York, for Jenkins' compressible valves and gauge cocks. Second medal and diploma.

D. L. Chase, Boston, Mass., for a safety boiler feeder. Third medal and certificate.

Hutchinson, Lawrence & Co., 38 Cortlandt street, New York, for Collinson's grate bars. Second medal and diploma.

L. B. Tupper, 39 One Hundred and Twenty-ninth street, New York, for grate bars. Third medal and certificate.

P. Quinn, South New Market, N. H., for a device for repairing boiler flues. Third medal and certificate.

Norman Wiard, 175 Broadway, New York, for a steam boiler attachment. First medal and diploma.

A. J. Maris, 259 West Twenty-ninth street, New York, for gauge cocks and low water detector. Second medal and diploma.

A. Schmidt, 41 Center street, New York, for a recording steam gauge. Third medal and certificate.

Robert Berryman,* Philadelphia, Pa., for an automatic low water detector. First medal and diploma.

J. W. Blake & Co., 56 John street, New York, for Massey's low water detector. Third medal and certificate.

* Reported on by the judges at large.

DEPARTMENT V.—GROUP 2.

Judges—Messrs. WILLIAM S. AUCHINCLOSS, M. M. LIVINGSTON, J. S. GRIFFITH.

Knowles & Sibley, 126 Liberty street, New York, for the best direct acting steam pump. First medal and diploma.

C. B. Hardick, 9 Adams street, Brooklyn, N. Y., for a direct acting Niagara steam pump. Second medal and diploma.

George F. Blake & Co., Boston, Mass., for a direct acting steam pump. Third medal and certificate.

C. B. Hardick, 9 Adams street, Brooklyn, N. Y., for the best steam crank pump First medal and diploma.

Woodward Steam Pump Manufacturing Company, 76 to 80 Center street, for a steam crank pump. Second medal and diploma.

Bridgeport Manufacturing Company, 55 Chambers street, New York, for a factory pump. Second medal and diploma.

T. F. Rowland, Continental Works, Greenpoint, L. I., for the best rotary pump. First medal and diploma.

P. S. Justice, Philadelphia. Pa., for a steam pumping engine. Second medal and diploma.

J. H. A. Gericke, 25 Montgomery street, Jersey City, N. J., for a turbinate force pump. First medal and diploma.

W. D. Andrews & Brother, 414 Water street, New York, for the best anti-friction centrifugal pump. First medal and diploma.

H. C. Dart & Co., 5½ Pine street, New York, for a displacement rotary pump. Second medal and diploma.

J. W. Cole & Co., 35 and 37 Park Place, New York, for the best vertical feed pump. Second medal and diploma.

Bridgeport Manufacturing Company, Bridgeport, Conn., for the best force, ship and well pump. Second medal and diploma.

Jules Cheron, 28 and 30 Greene street, New York, for a portable garden force pump. Second medal and diploma.

New York Hydraulic Machine Company, 63 Crosbie street, New York, for a rotary hand pump. Second medal and diploma.

Wm. Sellers & Co., Philadelphia, Pa., for the best injector. First medal and diploma.

John P. Gruber, 182, 184, 186 and 188 Chatham Square, New York, for water works for dwellings. First medal and diploma.

A. F. Burnham, York, Pa., for a turbine water wheel. Second medal and diploma.

Wm. S. Carr & Co., 106 Centre street, New York, for the best house pump. Second medal and diploma.

J. D. West & Co., 40 Cortlandt street, New York, for a force pump. First medal and diploma.

Bridgeport Manufacturing Company, 55 Chambers street, New York, for the best sink pump. Second medal and diploma.

Boughton & Moore, 41 Centre street, New York, for the best positive feed oil cups. Second medal and diploma.

Nathan & Dreyfus, 108 Liberty street, New York, for the best automatic oil cups. Second medal and diploma.

J. B. Wickersham, Philadelphia, Pa., for the American oil feeder. Second medal and diploma.

C. Merrill & Sons, 556 Grand street, New York, for a very superior and efficient fan blower. First medal and diploma.

S. S. Townsend, 31 Liberty street, New York, for the best pressure blower. First medal and diploma.

P. Clark, Rahway, N. J., for multiplying pressure fan blowers. First medal and diploma.

Cole Bros., Pawtucket, R. I., for a steam fire engine. First medal and diploma.

Gaylord Coupling Company, 18 Dey street, New York, for a patent hose coupling. First medal and diploma.

Taylor & Courtlandt,* 62 Broadway, New York, for the Empire hose coupling. Second medal and diploma.

Wm. H. Haight, 18 Dey street, New York, for a hose sprinkler. Second medal and diploma.

Department V.—Group 3.

Judges—Messrs. Edward Haas, Samuel Lewis.

Chelsea Machine Works, Norwich, Conn., for a foot lathe. Second medal and diploma.

Edward P. Ryder, 220 Center street, New York, for a foot lathe. Third medal and certificate.

Wood, Light & Co., Worcester, Mass., for bolt cutters. First medal and diploma.

William Sellers & Co., Philadelphia, Pa., for a bolt cutter. Second medal and diploma.

Parker Brothers, West Meriden, Conn., for power presses. First medal and diploma.

N. C. Stiles, Middletown, Conn., for punching machines. Second medal and diploma.

Wood, Light & Co., Worcester, Mass., for a shafting lathe. First medal and diploma.

Chelsea Machine Works, Norwich, Conn., for an engine lathe. First medal and diploma.

William Sellers & Co., Philadelphia, Pa., for a single lathe. Second medal and diploma.

Hewes & Phillips, Newark, N. J., for an engine lathe. Second medal and diploma.

P. Blaisdell, Worcester, Mass., for an engine lathe. Second medal and diploma.

Lucius W. Pond, Worcester, Mass., for an engine lathe. Third mdal and certificate.

William Sellers & Co., Philadelphia, Pa., for an iron planer. First medal and diploma.

Hewes & Phillips, Newark, N. J., for an iron planer. Second medal and diploma.

William Sellers & Co., Philadelphia, Pa., for a shaping machine. First medal and diploma.

Hewes & Phillips, Newark, N. J., for a shaping machine. Second medal and diploma.

Hewes & Phillips, Newark, N. J., for a gear cutter. Third medal and certificate.

Hewes & Phillips, Newark, N. J., for a boring machine. Second medal and diploma.

* Reported on by the judges at large.

William Sellers & Co., Philadelphia, Pa., for a slotting machine. First medal and certificate.

Hewes & Phillips, Newark, N. J., for a slotting machine. Third medal and certificate.

Lucius W. Pond, Worcester, Mass., for an index milling machine. First medal and diploma.

P. Blaisdell, Worcester, Mass., for a milling machine. Second medal and diploma.

Charles Merrill & Sons, 556 Grand street, New York, for an air spring forging-hammer. First medal and diploma.

Philip S. Justice, Philadelphia, Pa., for a power hammer. Second medal and diploma.

Merrick & Sons, Philadelphia, Pa., for a steam hammer. First medal and diploma.

Richard Dudgeon, 205 East Broadway, New York, for a steam hammer. First medal and diploma.

Charles Merrill & Sons, 556 Grand street, New York, for a drop hammer. First medal and diploma.

A. P. & M. Stephens & Co., 91 Liberty street, New York, for a rotary cutter for metals. Second medal and diploma.

Mays & Bliss, Brooklyn, N. Y., for a double action power press. First medal and diploma.

Farrel Foundery and Machine Company, Waterbury, Conn., for a double action power press. Second medal and diploma.

Mays & Bliss, Brooklyn, N. Y., for a lever press. First medal and diploma.

J. E. Conner, 71 Adams street, Brooklyn, N. Y., for a lever press. Second medal and diploma.

N. C. Stiles, Middletown, Conn., for a lever press. Second medal and diploma.

The Judd Manufacturing Company, New Haven, Conn., for a riveting machine. First medal and diploma.

The Judd Manufacturing Company, New Haven, Conn., for adjustable clamps Second medal and diploma.

Warren Lyon, 796 Greenwich street, New York, for shears and punching presses. Third medal and certificate.

New Jersey File Company, Newark, N. J., for a file cutting machine. Second medal and diploma.

Coburn & Van Patten, Auburn, N. Y., for a friction hand drill. Third medal and certificate.

Hugh, Thomas & Robert Wallace, 353 West Thirty-fifth street, for reversible rachet wrench. Third medal and certificate.

J. Bayliss, 147 East Fifty-fourth street, New York, for hot blast and water tuyeres. First medal and diploma.

J. R. Harrington, 73 Fourth avenue, New York, for improved tuyere irons for blacksmiths' forges. Third medal and certificate.

James Patterson, Williamsburgh, N. Y., for a blacksmith's forge. Third medal and certificate.

R. J. Allen, 81 Newark avenue, Jersey City, N. J., for a bolt carrier. Third medal and certificate.

B. W. Robbins, Jersey City, N. J., for hand-forged twist drills. Second medal and diploma.

Isaiah Nutt, corner of First avenue and Fifty-fifth street, New York, for a steam pipe valve refitting machine. Third medal and certificate.

William H. Haight, 18 Dey street, New York, for a reunion chuck. Third medal and certificate.

Reed & Bowen, 36 Kilby street, Boston, Mass., for a combined shear, punch, upsetter and bender. Second medal and diploma.

Richard Dudgeon, 305 East Broadway, New York, for boilermakers' tools. First medal and diploma.

Albert Bridges, 46 Cortlandt street, New York, for jack screws. Second medal and diploma.

Anson P. Stephens, 91 Liberty street, New York, for the best vises. Second medal and diploma.

Q. S. Backus, Windsor, Vt., for telescope vises. Second medal and diploma.

Parker Brothers, West Meriden, Conn., for a bench vise. Third medal and diploma.

H. B. Smith & Co., 42 Duane street, New York, for a combination pipe vise. Third medal and certificate.

S. Farrer & Co., 212 Grand street, New York, for a pipe cutter. Third medal and certificate.

Oberlin & Smith, Bridgeton, N. J., for gasfitters' tools. Second medal and diploma.

New York Tap and Die Company, 117 Liberty street, New York, for taps and dies and emery wheels. Second medal and diploma.

American Standard Tool Company, Newark, N. J., for a case of twist drills. First medal and diploma.

A. Hoermann, 5 Tryon row, New York, for dies for cutting screws. Third medal and certificate.

Northampton Emery Wheel Company, Leeds, Mass., for emery wheels and machine. Second medal and diploma.

Freeman K. Sibley, Auburndale, Mass., for emery and crocus cloth. Third medal and certificate.

Gaylord Coupling Company, 18 Dey street, New York, for a patent machine oiler. Third medal and certificate.

Department V.—Group 4.

Judges—Messrs. Edward A. Raymond, Elisha Waters, Edward Bierstadt.

R. McChesney, Birmingham, Conn., for a scroll saw. First medal and diploma.

Hampson & Copeland, 42 Courtlandt street, New York, for a scroll saw. Second medal and diploma.

H. L. Beach, Montrose, Pa., for a scroll saw. Third medal and certificate.

First & Pryibil, 452, 454 and 456 Tenth avenue, New York, for a beam saw. Third medal and certificate.

John T. Plass, 202 East Twenty-ninth street New York, for a band saw. Second medal and diploma.

First & Pryibil, 452, 454 and 456 Tenth avenue, New York, for a band saw. Third medal and certificate.

J. P. Grosvenor, Lowell, Mass., for a circular saw bench. Second medal and diploma.

Roff & Huntington, Newark, N. J., Geo. L. Cummings, agent, 140 Centre street, New York, for a circular saw bench. Third medal and certificate.

Roff & Huntington, Newark, N. J., Geo. L. Cummings, agent, 140 Centre street, New York, for a clap-board saw. Second medal and diploma.

C. B. Rogers & Co., Norwich, Conn., for circular saw arbors. Third medal and diploma.

M. B. Tidey, Newark, N. J., for a self-oiling saw mandrill and universal grove. Second medal and diploma.

Baker & Noyes, Manchester, N. H., for a saw guide and jointer gauge. Second medal and diploma.

Wm. H. Hoag, 214 Pearl street, New York, for hand power sawing machine. Second medal and diploma.

Circular Rip Saw Company, 180 Fulton street, New York, for circular rip saws. Third medal and certificate.

R. Hoe & Co., 29 and 31 Gold street, New York, for the largest and best variety of circular saws. First medal and diploma.

American Saw Company, 2 Jacob street, New York, for circular saws. First medal and diploma.

Wheeler, Madden & Clemsen, Middletown, N. Y., for circular saws with inserted teeth. Third medal and certificate.

Bissell & Moore, 72 Beekman street, New York, for electric hand saws. Second medal and diploma.

Brissell & Moore, 72 Beekman street, New York, for arch bow saw frames. Third medal and certificate.

John B. Schenck & Son, 118 Liberty street, New York, for a Woodworth's planer. First medal and diploma.

S. A. Woods, 91 Liberty street, New York, for a No. 2 Woodbury planer and matcher. Second medal and diploma.

S. A. Woods, 91 Liberty street, New York, for a 2 Woodbury moulding machine (inside head). First medal and diploma.

C. B. Rogers & Co., Norwich, Conn., for an inside head moulding machine. Second medal and diploma.

Roff & Huntington, Newark, N. J., George L. Cummings, agent, 140 Center street New York, for an outside head moulding machine. First medal and diploma.

C. B. Rogers & Co., Norwich, Conn., for an outside head moulding machine. Second medal and diploma.

A. S. & J. Gear & Co., Concord, N. H., for a variety moulding machine. First medal and diploma.

C. B. Rogers & Co., Norwich, Conn., for a variety moulding machine. Second medal and diploma.

Roff & Huntington, Newark, N. J., George L. Cummings, agent, 140 Center street, New York, for a fluting machine. Second medal and diploma.

C. B. Rogers & Co., Norwich, Conn., for a rod machine. Second medal and diploma.

First & Pryibil, 175 Hester street, New York, for a counter balance oval turning lathe. First medal and diploma.

J. D. Barstow, Norwich, Conn., for a blind slat turning and stile boring machine. Second medal and diploma.

Martin Buck, Lebanon, N. H., for a blind morticing machine. Second medal and diploma.

Valentine H. Quinby, 185 Chambers street, New York, for work tables with lever treadle power. Second medal and diploma.

Metallic Plane Company, Auburn, N. Y., for metallic bench planes. Third medal and certificate.

Centerbrook Manufacturing Company, 117 Liberty street, New York, for single twist solid spur augur bits. Second medal and diploma.

DEPARTMENT V.—GROUP 5.

Judges—Messrs. GEORGE H. BABCOCK, ELISHA HARRIS, E. S. BOYNTON.

Atlas Company, Newark, N. J., for a double cylinder cotton gin. First medal and diploma.

Albany Agricultural Works, Albany, N. Y., for a universal cotton gin. Second medal and diploma.

Albany Agricultural Works, Albany, N. Y., for a cotton opener and feeder attachment for cotton gins. Third medal and certificate.

Albany Agricultural Works, Albany, N. Y., for a receiving, cleaning and condensing attachment for cotton gins. Third medal and certificate.

Wm. P. Hopkins, Lawrence, Mass., for a combination step for spindles. Second medal and diploma.

H. W. Butterworth, Philadelphia, Pa., for a warp dryer and cotton cans. Second medal and diploma.

Columbia Works, Philadelphia, Pa., for a centrifugal hydro-extractor. Second medal and diploma.

C. L. Goddard, 3 Bowling Green, N. Y., for Mestizo wool burring maching. First medal and diploma.

Charles G. Sargent, Graniteville, Mass., for a woolen burring and picking machine. Second medal and dlploma.

Atlas Manufacturing Company. Newark, N. J., for a patent double cylinder burr picker and mixing picker for all qualities and grades of wool. Second medal and diploma.

Frank Philip, Stockport, N. Y., for a heddle machine and heddles. First medal and diploma.

Sargent Card Clothing Company, Worcester, Mass., for card clothing. First medal and diploma.

Chapen & Downes, Providence, R. I., for a double cylinder gig. First medal and diploma.

Charles G. Sargent, Graniteville, Mass., for metallic waste card. First medal and diploma.

C. L. Goddard, 3 Bowling Green, N. Y., for intersecting steel feed rolls for attachment to cards. First medal and diploma.

Greene & Daniels, Pawtucket, R. I., for a complete set of machines for manufacturing thread. First medal and diploma.

T. A. Campbell, West Forty-third street, New York, for a wool oiling machine. Second medal and diploma.

Positive Motion Loom Company, 35 and 37 Wooster street, New York, for positive motion power looms for silk and woolen. Medal of honor.

C. L. Goddard, 3 Bowling Green, New York, for double and single solid steel ring burring machines. Second medal and diploma.

Palmer & Kendall, 158 Chatham street, for circular looms. First medal and diploma.

DEPARTMENT V.—GROUP 6.

Judges—Messrs. JOHN MATTHEWS, Jr., L. BRADLEY, J. H. BROWN.

Peter Burkhard, 125 White street, New York, for revolving steam pan for making sugar plums, coating pills, &c. First medal and diploma.

J. T. Daly, 43 New street, New York, for the Burleigh steam rock drill. First medal and diploma.

Charles W. Packard, Philadelphia, Pa., for a machine for cutting ovals, circulars, &c. First medal and diploma.

S. A. Woods, 91 Liberty street, New York, for a saw guiding machine. First medal and diploma.

Hotchkiss Brick and Tile Machine Company, 38 John street, New York, for a brick and tile machine. First medal and diploma.

DEPARTMENT V.—GROUP 7.

Judges—Messrs. JOHN MATTHEWS, Jr., L. BRADLEY, J. H. BROWN.

National Anti-friction Metal Company, 160 Fulton street, Jersey City, for national anti-friction metal. First medal and diploma.

J. W. Blake & Co., 56 John street, New York, for novelty anti-friction metal. Third medal and certificate.

The Baxter Wrench Company, 10 Park Place, New York, for the Baxter adjustable "S" wrench. Second medal and diploma.

B. Ackerman, 317 and 319 West Forty-fourth street, New York, for the universal screw wrench. Third medal and certificate.

B. Borden, Norwich, Conn., for patent combination wrenches and device for turning nuts. Third medal and certificate.

Wm. Kenyon & Sons, Steubenville, O., for a universal wrench. Third medal and certificate.

Green, Tweed & Co., 10 Park Place, New York, for belt studs. Third medal and certificate.

Wm. D. Andrews & Brother, 414 Water street, New York, for incline wrenches. Third medal and diploma.

Lyon & Fellows, 74 Beekman street, New York, for metal screws. First medal and diploma.

James Bogardus, corner Elm and White streets, New York, for an eccentric mill. First medal and diploma.

Edgar J. Amar, 114th street between First and Second avenues, New York, for screw drivers. Third medal and certificate.

Chesebrough & Co., 132 Maiden Lane, New York, for lubricating oils. First medal and diploma.

Salamander Felting Company, Troy, N. Y., for salamander felting covering for steam boilers, &c. Second medal and diploma.

R. Whitehill, 10 Bethune street, New York, for an arrangement for driving sewing machines by steam power. Second medal and diploma.

Douglass Manufacturing Company,* 45 Chambers street, New York, for superior mechanics' tools. First medal and diploma.

A. W. Whitney, Smithville, N. J., for tinmen's tools. First medal and diploma.

L. L. Davis, 252 Broadway, New York, for patent spirit level and plumb. Second medal and diploma.

J. W. Storrs & Co., 252 Broadway, New York, for file handles. Second medal and diploma.

Clement & Hawkes Manufacturing Company, Northampton, Mass., for a patent belt tightener. Second medal and diploma.

* Reported on by the judges at large.

R. Daniels, Woodstock, Vt., for Daniel's triple bearing. Third medal and certificate.

Chelsea Machine Works, Norwich, Conn., for a shaft coupling. Third medal and certificate.

Wm. Sellers & Co., Philadelphia, Pa., for shafting and coupling (exhibited in operation). First medal and diploma.

Wood, Light & Co., Worcester, Mass., for a patent coupling and lock for shafting. Second medal and diploma.

Charles Neer, 121 South Eighth street, Brooklyn, E. D., for rotary dynamometer and register, and rotary dynamometer and oil tester (exhibited in operation). First medal and diploma.

John M. D. Keating, New Haven Railroad Depot, Centre street, New York, for an envelop machine. Second medal and dipoma.

B. W. Leonard, Bridgeport, Mass., for a flouring mill and a grist mill. First medal and diploma.

J. F. Whitney & Co., 58 Washington street, New York, for mounted grindstones. Third medal and certificate.

A. Hitchcock, 109 Nassau street, New York, for fraction gearing. Second medal and diploma.

T. C. Entwisle, 2 Liberty street, New York, for Entwistle's transmitting motion. Second medal and diploma.

Nelson Tool Works, 161 East Thirty-second street, New York, for mining, paving and blacksmiths' tools. Second medal and diploma.

VI.—DEPARTMENT OF INTER-COMMUNICATION.

First Group.—Locomotive engines, cars, or models of the same, and all apparatus used in constructing and operating railways, models of bridges, etc. All fixtures, furniture and appliances used on passenger and freight railway cars.

Second Group.—Carriages, wagons, sleighs, and all vehicles drawn by animal power; harness, saddles, bridles, and all apparatus used in connection with the horse and the stable.

Specimens of improved material for making common roads and pavements, and all apparatus used in constructing the same and keeping them in repair.

Third Group.—Models of vessels for navigating the ocean, rivers, lakes and canals; all apparatus connected with building, propelling and steering vessels; models of locks, docks, aqueducts; structures and implements used in navigation.

Fourth Group.—Electric telegraphs, apparatus used in constructing overland and submarine telegraph lines.

All apparatus for giving signals and alarms; bells, etc.

Implements and contrivances used in transporting and distributing mails; package express, and implements connected therewith.

Hand machines, materials and implements used in printing, engraving and advertising.

Fifth Group.—Fire engines and apparatus used in extinguishing fires; fire escapes; apparatus used in making and conveying illuminating gas for towns and cities; gas meters.

Apparatus for supplying towns and cities with water; water meters.

Sixth Group.—Implements for expediting trade; contrivances used in the store and warehouse; scales; locks for stores and banks; safes hoisting apparatus; shutters; vault lights; reflectors, and iron columns, etc.

Specimens of ledgers, account books, blank books, tickets, tags, cards.

Business flags; glass and other ornamental signs; figure signs.

SEVENTH GROUP.—Army apparatus used in movements or in camp; flags. guns, pistols, swords; models of fortifications; apparatus used in the navy.

Articles and devices for school buildings and grounds.

Useful and ornamental work and devices for churches and cemeteries.

Articles and implements used on public works, not elsewhere designated.

DEPARTMENT VI.—GROUP 1.

Judges—Messrs. E. MILLER, S. SCHOCK, H. G. BROOKS.

J. A. Holmes, 36 Water street, New York, for a lock nut and washer. Second medal and diploma.

Field & Martin, 19 Chatham street, New York, for a lock nut. Third medal and certificate.

J. B. Kelly, Kendallville, Indiana, for a turn table. First medal and diploma.

Taylor Iron Works, High Bridge, N. J., for car wheels and car axles for railroad curves. Second medal and diploma.

Frank Hudner, 330 Avenue A, New York, for improved car wheels and axles for railroad curves. Second medal and diploma.

Taylor Iron Works, High Bridge, N. J., for Atwood's patent car wheels. Second medal and diploma.

J. W. Morse, 177 Nassau street, New York, for a model of elevated railroad car and suspension bridge. Second medal and diploma.

W. Hyde, 4 Cortlandt street, New York, for an elevated cable transit. Second medal and diploma.

Longhridge Car Brake Company, Thos. B. Oakley, agent, 33 Wall street, New York, for steam train brake for railways. First medal and diploma.

B. J. La Mothe, 54 Eighth avenue, New York, for model of a car and car seat. Second medal and diploma.

American Submarine Tunnel Company, 62 Wall street, New York, for model of cast iron underground railroad tunnel, wooden section of same, and model of a submarine tunnel. Second medal and diploma.

W. H. Darling, 337 Seventh avenue, New York, for lantern holder. Third medal and certificate.

Isaac P. Wendell, 51 South Fourth street, Philadelphia, Pa., for self-oiling journal bearing. Second medal and diploma.

DEPARTMENT VI.—GROUP 2.

Judges—Messrs. JAMES A. WHITNEY, WM. RUTTER.

Pickering & Davis, 144 Green street, New York, for velocipedes. Second medal and diploma.

L. W. Boynton, Hartford, Conn., for a three wheeled velocipede. Third medal and certificate.

Geo. J. Moore, 376 Bowery, New York, for a single seat wagon. Second medal and diploma.

Auguer & Burnap, Poughkeepsie, N. Y., for steel buggy gearing. Second medal and diploma.

Barnett's Manufacturing Company, 240 Canal street, New York, for a carriage top rest. Second medal and diploma.

A. Christian, 65 Maiden Lane, New York, for perambulators and three wheeled velocipedes. Third medal and certificate.

H. Carter & Son, 290 Pearl street, New York, for Bemis' carriage jack. Third medal and certificate.

John Monk, 229 Tenth avenue, New York, for a carriage wheel with metallic hub. Second medal and diploma.

Hawley, McLure & Co., Utica, N. Y., for a collection of wagon axles, wagon skeins and whiffletree hooks. Third medal and certificate.

Sebastian & Saal, 704 Third avenue, New York, for improvements on wagons and seat springs. Third medal and certificate.

John C. Ham, 10 East Fourth street, New York, for a patent six seat circular clarence front family carriage. First medal and diploma.

The New York Saddle and Pad Company, 2 Rector street, New York, for rubber lined horse collars, saddles and pads. Third medal and certificate.

B. T. Henry, New Haven, Conn., for a single plate carriage spring. Third medal and certificate.

Alfred Woodham, 221 Canal street, New York, for hoof cushions. Third medal and certificate.

Goodenough Horse Shoe Company, 41 Dey street, New York, for horse shoes. First medal and diploma.

G. W. Barnes & Son, 315½ Bowery, New York, for a safety head stall. Third medal and certificate.

Rubber Coated Harness Company, Newark, N. J., for hard rubber coated harness mountings. First medal and diploma.

Chas. M. Theberath and Bro., 40 Mechanics street, Newark, N. J., for saddlery hardware. Second medal and diploma.

J. V. Waldron, 46 Beekman street, New York, for harness ornaments. Third medal and certificate.

Charles Fraser, corner Reade and Hudson streets, New York, for a case of bridle fronts. Third medal and certificate.

Hotchkiss' Sons, 55 Chambers street, New York, for curry combs. Third medal and certificate.

DEPARTMENT VI.—GROUP 3.

Judges—Messrs. WM. L. HULL, ALDEN S. SWAN, JOS. E. DUNHAM.

Waters, Balch & Co., Troy, N. Y., for paper boats. First medal and diploma.

Stephen Roberts, 114th street, Harlem, N. Y., for a cedar shell boat. Second medal and diploma.

E. W. Page, 69 West street, New York, for superior ash and spruce oars. Third medal and certificate.

Ryerson, Tripp & Chambers, 428 West Twenty-fifth street, New York, for boat detaching apparatus. Third medal and certificate.

John P. Teale, 165 Broadway, New York, for model of a steamboat with patent rudder locks. Third medal and certificate.

Frederick Wittram, Washington, D. C., for a patent anchor. Second medal and diploma.

Nathan & Dreyfus, 105 Liberty street, New York, for Vic's india rubber life boat. Third medal and certificate.

Geo. Naunton, Twenty-sixth street, between Ninth and Tenth avenues, for model of a ship. Third medal and certificate.

John S. Midwinter, Port Washington, N. J., for caulkers' and other mops. Third medal and certificate.

Tucker, Carter & Co., 70 South street, New York, for wire rope. First medal and diploma.

L. Cantel, 448 West Forty-first street, New York, for a model of a life preserving boat. Second medal and diploma.

B. F. Miller, 452 Vandam street, New York, for models of boats. Second medal and diploma.

Department VI.—Group 4.

Judges—Dr. Dubois D. Parmelee, Prof. P. H. Vander Weyde, Prof. John Phin.

American Air Alarm Company, 176 Broadway, New York, for an air alarm. Second medal and diploma.

Banks & Martin, Wallingford, Conn., for and office indicator. Third medal and certificate.

C. W. Eastwood & Co., 248 Canal street, New York, for a private letter box. Second medal and diploma.

American Fire Detector Company, 585 Broadway, New York, for a fire detector and anunciator. Second medal and diploma.

L. Drescher, 1127 Third avenue, New York, for electro-magnetic machines. Third medal and certificate.

American Compound Telegraph Wire Company, 234 West Twenty-ninth street, New York, for telegraph wire. Second medal and diploma.

Samuel Gardiner, 171 Broadway, New York, for an electric indicator. First medal and diploma.

Samuel Gardiner, 171 Broadway, for and electric apparatus for lighting gas. First medal and diploma.

A. L. Bogart, 702 Broadway, New York, for the Wilson electric apparatus for lighting gas. Second medal and diploma.

James Gregory, 112 Cannon street, for a gong. Second medal and diploma.

Jerome Kidder, 544 Broadway, New York, for a portable electro-medical apparatus, for an equal alternating electro-medical apparatus, for an electrical apparatus to test magnets, for a pocket electro-medical apparatus, for a case of electrical appliances for electrical apparatus, for a traveling electro-medical apparatus, for an electrical water bath, for a current changing electro-medical apparatus. First medal and diploma.

Ganme, Bastel & Co., 535 Broadway, New York, for an application for driving sewing machines and analogous small machines by electricity. First medal and diploma.

Department VI.—Group 5.

Judges—Messrs. Noah Worrall, Peter C. Baker, Philip A. Fitzpatrick.

Bullock Printing Press Company, Philadelphia, Pa., for a self-feeding and perfecting printing press. First medal and diploma.

B. O. Woods, Boston, Mass., for printing presses and novelty type cases. Third medal and certificate.

Department VI.—Group 6.

Judges—Messrs. A. W. Hall, Wm. H. Murphy, Geo. W. Sebring.

Albertson & Douglass Manufacturing Company, New London, Conn., for model of a Segment screw cotton and hay press. Third medal and certificate.

Edmund W. Gilman, Hunter's Point, N. Y., for a stair shifter. Third medal and certificate.

Thomas G. Tyler, 73 Vandam street, New York, for a rise and fall awning. Third medal and certificate.

W. Demuth & Co., 403 Broadway, New York, for metal and wood figures. First medal and diploma.

T. Shriver & Co., 333 East Fifty-sixth street, New York, for the best copying presses and brushes. One of the firm being a manager, they are debarred from receiving a premium.

H. C. Bowen, 59 Lewis street,. New York, for copying presses. Second medal and diploma.

Walter Hyde, 4 Cortlandt street, New York, for a chesse cutter. Third medal and certificate.

Alexander Burns, 295 Front street, New York, for an oval harness cask. Third medal and certificate.

Sampson Scale Co., 240 Broadway, New York, for platform scales. First medal and diploma.

Sargeant & Greenleaf, Rochester, N. Y., for a sample of bolt work for locks. Third medal and certificate.

John T. Dunkin, 181 Canal street, New York, for a measuring and rolling machine. Second medal and certificate.

W. H. Rogers, South Second street, Brooklyn, E. D., N. Y., for a funnel, measure and strainer. Third medal and certificate.

B. Ryer & Sons, 58 and 60 Doughty street, Brooklyn, N. Y., for vault covers. Third medal and certificate.

Steitz & Dreier, 76 William street, N. Y., for glass signs and letters and ornamental etchings on glass. First medal and diploma.

G. W. Banker, 129 Maiden lane, New York, for oil cans. Third medal and certificate.

Elmira Seamless Keg Co., Elmira, N. Y., for seamless packages. Second medal and diploma.

L. H. Olmstead, Brooklyn, N. Y., for bill files. Third medal and certificate.

Wm. Marx, 541 Broome street, New York, for fractional target scales. Third medal and certificate.

Wm. H. Core, 133, Chatham street, New York, for a show case. Third medal and diploma.

New York Hydraulic Machine Co., 63, Crosby street, New York, for a measuring faucet. Third medal and certificate.

Chas. McColley, 191 Lewis street, New York, for a sample of carving. Third medal and certificate.

John W. Tyler, 636 Broadway, New York, for an open-work banner. Third medal and certificate.

Heath & Smith Manufacturing Co., 44 Murray street, New York, for a graining machine. Second medal and diploma.

John Matthews, Seventy-fifth street, New York, for an automatic tumbler washer. First medal and diploma.

John Matthews, Seventy-fifth street, New York, for a case for holding and transporting bottles. Third medal and certificate.

John Matthews, Seventy-fifth street, New York, for a tumbler washer. Second medal and diploma.

McLewee & Putnam, 561 Broadway, New York, for prismatic glass signs. Third medal and certificate.

Heath & Smith Manufacturing Co., 44 Murray street, New York, for a street lamp. Second medal and diploma.

J. H. Kramer, 180 Grand street, New York, for ornamental lanterns and street lamps. First medal and diploma.

F. P. Doyle, 237 Center street, New York, for lanterns. Third medal and diploma.

George Wilson, 30 and 32 Plymouth street, Brooklyn, New York, for a card rack. Third medal and certificate.

John J. Bockee, Jr., 78 Maiden Lane, New York, for japanned cans and cannisters. Third medal and certificate.

E. Bierstadt, Jersey City, New Jersey, James M. Tower, agent, 254 Broadway, New York, for the best cancelling stamp. First medal and diploma.

Edward L. Wilson, Philadelphia, Pennsylvania, for photographic head and body rest. Second medal and diploma.

J. N. Burns,* 64 Fulton street, New York, for stencil plates. Third medal and diploma.

DEPARTMENT VI.—GROUP 7.

Judges—Messrs. W. B. HARRISON, LEWIS CARR.

American Patent Extension Ladder Co., 69 Liberty street, New York, for a fire truck and ladder. Second medal and diploma.

C. Weidling and C. T. Seymour, 189 Pearl street, New York, for a fire truck and ladder. Third medal and certificate.

Parker Bros., West Meriden, Conn., for shot guns. First medal and diploma.

J. Stevens & Co., 252 Broadway, New York, for specimens of pistols. Second medal and diploma.

Edward E. Darrow, 35 Spruce street, New York, for leather hose. Third medal and certificate.

New England Linen Hose Manufacturing Co., Boston, Mass, for linen hose. Third medal and certificate.

Globe Fire Extinguisher Co., 4 Dey street, New York, for fire extinguishers. Second medal and diploma.

VII.—DEPARTMENT OF AGRICULTURE AND HORTICULTURE.

FIRST GROUP—Plants and flowers.

SECOND GROUP—Fruits, vegetables, cereals, roots and seeds.

THIRD GROUP—Food prepared on the farm—butter, cheese, &c.

FOURTH GROUP—Ploughs, diggers, cultivators, harrows, drain pipe, and implements used in preparing the soil; pruning knives, and all implements for cultivating plants and trees; hot house apparatus.

FIFTH GROUP—Mowers, reapers, scythes, and implements used in gathering the products of the soil. Threshing machines, corn shellers, grain and other farm mills.

SIXTH GROUP—Churns, cheese presses, and all articles used in dairy, farm house, and farm stables, not elsewhere enumerated.

* Reported by the judges at large.

Seventh Group—Products of the soil used in the arts—wood, hemp, flax, cotton, etc. Products of animal growth—wool, silk, hair, feathers, down, horn, bone.

Live animals, whenever the board of managers shall decide to admit them.

Department VII.—Group 1 and 2.

Judges—Messrs. P. V. Le Roy, Walton Carpenter.

Misses A. & E. Asmus, 183 Washington street, Hoboken, N. J., for hand bouquets. Second medal and diploma.

A. G. Burgess, East New York, L. I., for a collection of dahlias. Second medal and diploma.

W. A. Burgess, Glen Cove, L. I., for a collection of cut roses. First medal and diploma.

Ellwanger & Barry, Rochester, N. Y., for the largest collection of pears. First medal and diploma.

Wm. L. Ferris, Throg's Neck, N. Y., for the second largest collection of pears. Second medal and diploma.

Thos. Grigg, Vineland, N. J., for the best five varieties of pears. First medal and diploma.

B. H. Hart, Poughkeepsie, N. Y., for the largest collection of apples. First medal and diploma.

Wm. L. Ferris, Throgs Neck, N. Y., for the second largest collection of apples. Second medal and diploma.

C. B. Campbell, Vineland, N. J., for the best five varieties of apples. Second medal and diploma.

C. B. Campbell, Vineland, N. J., for the second best five varieties of apples. Second medal and diploma.

S. Springstead, Union Port, N. Y., for the best collection of peaches, five varieties. First medal and diploma.

R. T. Underhill, Croton Point, N. Y., for the largest collection of out-door grapes. First medal and diploma.

Reisig & Hexamer, Newcastle, N. Y., for two hundred varieties of potatoes. First medal and diploma.

J. L. Conover, Red Bank, N. J., for the second largest collection of potatoes. Second medal and diploma.

S. Springstead, Union Port, N. Y., for the best bushel of potatoes (early rose). Second medal and diploma.

Samuel Ruth, gardener, Blackwell's Island, for a collection of vegetables. First medal and diploma.

W. H. Archer, Williamsburgh, L. I., for the best cheese tomatoes. Second medal and diploma.

S. Springstead, Union Port, N. Y., for a collection of squashes. Second medal and diploma.

R. H. Leonard, Middletown, N. J., for six large water melons. Second medal and diploma.

Mahlon Moon, Morrisville, Pa., for a collection of hardy evergreens. Second medal and diploma.

DEPARTMENT VI.—GROUP 4.

Judges—Messrs. F. D. CURTIS, JOSIAH H. MACY, SIMEON LELAND.

Fords & Howe, Oneonta, N. Y., for a two-horse cultivator. First medal and diploma. For a one-horse cultivator. First medal and diploma.

S. Springstead, Union Port, N. Y., for a weeding hoe and propelling weeder. First medal and diploma.

Collin's Plow Co., 212 Water street, New York, for caststeel plows, First medal and diploma.

Griffin & Co., 58 and 60 Cortlandt street, New York, for caststeel plows. Second medal and diploma.

New York Harrow Association, 35 and 37 Park Place, New York, for a rotary harrow. First medal and diploma.

R. H. Allen & Co., 191 Water street, New York, for a cylinder plow. Third medal and certificate; for a potato plow. Third medal and certificate.

Norris & Miller, 110 Forty-seventh street, New York, for drain pipe, elbows, junctions, curves, &c. Second medal and certificate.

Thomas Christie, 324 West Forty-eighth street, New York, for cedar tubs for plants. Second medal and diploma.

Benjamin Haskell, 190 Duane street, New York, for Willimson's whiffle-tree for double teams. First medal and diploma.

George H. White, 25 West Twenty-seventh street, New York, for modal of a road scraper. First medal and diploma.

E. D. and O. B. Reynolds, North Bridgwater, Mass., for a seed sower. First medal and diploma.

Gray, Reynolds & Sanborn, Addison, N. Y., for samples of plow handles. First medal and diploma.

DEPARTMENT VII.—GROUP 5.

Judges—Messrs. F. D. CURTIS, JOSIAH H. MACY, SIMEON LELAND.

Adriance, Platt & Co., 165 Greenwich street, New York, for a mower and reaper combined with self-rake. First medal and diploma.

American Agricultural Works, Twenty-fourth street and Tenth avenue, New York, for a mower and reaper combined with self-rake. Second medal and diploma.

Adriance, Platt & Co., 165 Greenwich street, New York, for a mowing machine. First medal and diploma.

American Agricultural Works, Twenty-fourth street and Tenth avenue, New York, for a mowing machine. Second medal and diploma.

Ames Plow Co., 53 Beekman street, New York, for the American Hay Tedder. First medal and diploma.

J. C. Stoddard, Worcester, Mass., for a self-operating hay rake. First medal and diploma.

Daniels Machine Co., Woodstock, Vt., for power and hand hay and straw cutters. Second medal and diploma.

D. A. Dickinson, 125 Fulton street, New York, for a corn husker and sheller, and model of a corn bin. First medal and diploma.

Daniels Machine Co., Woodstock, Vt., for a cider press and cider mill. Second medal and diploma.

L. W. Nichols, West Sterling, Mass., for a fruit safe. Third medal and certificate.

R. H. Allen & Co., 91 Water street, New York, for a water barrel on wheels. Third medal and certificate.

S. N. Prentiss & Co., 249 West Twenty-eighth street, New York, for a grist and hominy mill. Second medal and diploma.

Ross Brothers, Williamsburgh, N. Y., for a grist mill. Third medal and certificate.

James A. Robinson, 164 Duane street, New York, for a corn husker. Second medal and diploma.

Department VII.—Group 6.

Judges—Messrs. F. D. Curtis, Josiah H. Macy, Simeon Leland.

G. W. Packard & Co., Mystic River, Conn., for a wall builder and stump extractor. First medal and diploma.

N. Chapman, Hopedale, Mass., for a cotton and hay press. First medal and diploma.

N. Chapman, Hopedale, Mass., for a churn. First medal and diploma.

John A. Lee, 119 Nassau street, New York, for animal traps. First medal and diploma.

John Savery's Sons, 97 Beekman street, New York, for Murdock's farmers' boilers. Second medal and diploma.

H. C. Bowen, Tarrytown, New York, for differential screw lard presses. Second medal and diploma.

H. C. Bowen, Tarrytown, N. Y., for meat cutters. First medal and diploma.

Geo. L. Cummings, 140 Centre street, New York, for the best carriage jack. Second medal and diploma.

Daniel's Machine Company, Woodstock, Vt., for a carriage jack. Third medal and certificate.

Judges at large—Dr. Dubois D. Parmelee, Lewis Carr, Esq., and Prof. James A. Whitney.

TEST OF STEAM ENGINES ON EXHIBITION.

NEW YORK, *December* 30, 1869.

To the Managers of the American Institute Exhibition:

GENTLEMEN.—Inclosed please find the report of the judges on steam engines, with copies of all official letters and reports necessary to a full understanding of the proceedings in the matter.

Respectfully yours,

THOMAS J. SLOAN,
HAMILTON E. TOWLE,
ROBERT WEIR,
Judges Dep. V., Group 1, *Division* 1.

EXHIBIT A.

AMERICAN INSTITUTE EXHIBITION,
NEW YORK, *October* 1, 1869.

MR. CHARLES E. EMERY, *Superintendent of the Exhibition:*

DEAR SIR.—It will doubtless be necessary, when the judges are appointed in the first and second groups of the Fifth Department, to aid them somewhat by practical trials of the steam engines, boilers, pumps, &c.

Our time is limited, and we are having considerable difficulty in finding suitable persons whose leisure will permit them to act as judges; so we shall be obliged to make preparations for the trials before the judges are appointed.

Please examine the means which can be made available for this purpose without materially interfering with the exhibition, and recommend to this committee such trials as you consider necessary, having due regard to economy of time and expenditures.

Very truly yours,

(Signed) W. H. BUTLER,
Chairman Fifth Department.

EXHIBIT B.

SUPERINTENDENT'S OFFICE, AMERICAN INSTITUTE EXHIBITION,
NEW YORK, *October 5th*, 1869.

WM. H. BUTLER, ESQ., *Chairman Department V:*

DEAR SIR.—In response to your letter of the 1st instant, in respect to the practical tests of steam engines, &c., entered for competition at this exhibition, I would respectfully report as follows:

It is desired by the exhibitors that the large steam engines be subjected to thorough practical tests, and I believe this to be necessary in order to enable the judges to act understandingly.

In anticipation of such trials arrangements have already been made whereby all the machinery in motion in the exhibition, may be driven by either of the engines; and the steam pipes are so arranged that either of the engines can receive steam from either of the boilers, without interfering with the working of the remaining engines from the other boiler. There is not sufficient time to make a thoroughly scientific test, which shall include all the points that can possibly arrise. We can, however, make some valuable practical trials sufficient to determine if their be any important difference in the engines exhibited. I propose to compare the economy of the engines by the weight of water evaporated into steam required to produce one net horse-power.

This may be ascertained by attaching a watermeter to one of the boilers and dynamometers to the shafting. By this means the power developed can be ascertained by inspection at any moment, and the mean power established by numerous observations. Indicator diagrams may also be taken. The coal may also be weighed; but this plan is liable to inaccuracy, for the furnaces are large, and it will be difficult to continue any experiment uninterruptedly, longer than eight hours. I can have the use of the dynamometers and meter, by simply paying for putting them up.

The boilers *should* be tested by ascertaining the amount of water evaporated per pound of coal; but, as considerable water is lifted with the steam of some of the boilers, it will be best to connect each of the large boilers in turn, to the same engine, and ascertain the water and fuel required to do the work. I do not consider that we will have time to make also a practical trial of steam pumps. The tests at the last exhibition were very thorough, and will, perhaps, assist the judges at this time. The centrifugal pumps ought to be

practically tested; but in order to try them in the limited time, the exhibitors should, by agreement, make their arrangements for the purpose.

Very truly yours,

(Signed) CHARLES E. EMERY,
General Superintendent of Exhibition.

EXHIBIT C.

Charles E. Emery, *Superintendent of Exhibition:*

Dear Sir.—The above plan is approved. You will please make all necessary arrangements to carry it into effect. Please confer also with the judges after they are appointed; submit our action to their approval and ascertain what further experiments they may desire. Also arrange with them the details of the proposed trials.

We cannot ask the judges to personally conduct the experiments. Please employ whatever assistance they may consider necessary and furnish them all the facilities in your power to enable them to ascertain the necessary facts. If they desire it, there is no objection to your relieving them to the extent of taking immediate charge of the experiments, under their supervision.

(Signed) W. H. BUTLER,
Chairman of Committee.

Note.—At this stage of the proceedings, the judges on steam engines were announced to be Mr. Thos. J. Sloan, Mr. Hamilton E. Towle, Mr. Robert Weir.

EXHIBIT D.

American Institute Exhibition,
New York, *October* 21*st*, 1869.

To Mr. Charles E. Emery, *General Superintendent:*

Dear Sir.—You will please observe the accompanying regulations (Exhibit E) in relation to the practical trials of the steam engines entered for competition, and report any objection that may be made by any exhibitor.

Very respectfully,

(Signed) THOS. J. SLOAN,
HAMILTON E. TOWLE,
ROBERT WEIR,
Judges.

EXHIBIT E.

American Institute Exhibition,
New York, *Oct.* 21*st*, 1869.

Regulations Prescribed by the Judges, for the Practical Trials of the Steam Engines Entered for Competition at this Exhibition.

1. Experiments will be made to ascertain the relative economy of the different engines.

To accomplish this, each engine will in turn be selected to drive the machinery in motion.

The resistance will be kept as nearly uniform as possible and the other engines be required to keep their clutch-pulleys in motion at full speed to avoid friction.

The power exerted will be ascertained by indicating the engine and by dynamometers now in position on the shafting.

Observations and diagrams will be taken every fifteen minutes, or more frequently if the load varies greatly.

The steam for the engine undergoing trial, will be supplied by the Harrison boiler, which will be so arranged that no steam is used from it for any other purpose.

The water supplied to and evaporated in that boiler will be measured by means of a meter, and the coal burned may also be weighed.

Each engine will be required to drive the main shaft at 250 revolutions.

The speed of each engine is supposed to have been already arranged by the exhibitor in ordering his pulley.

The steam pressure shall be kept as nearly as possible at eighty pounds above the atmosphere, to be measured in the steam-chest, of the engine if desired.

2. A trial will be made of the regulating apparatus of each engine to ascertain the effect of suddenly changing the load or pressure.

Trials will also be made to ascertain the difference *in speed* of each engine when working regularly under different loads and steam pressures.

Also trials to determine through what range of steam pressure each engine will run at regular speed; the regulation, in all cases, to be performed entirely by the governor with a wide throttle.

The judges may also derange, if possible, the regulating apparatus

of each engine to ascertain the probable result of accidents, and will make particular examination to determine the facility with which the valves and working parts may be inspected, adjusted or removed for repairs.

3. The judges may desire the exhibitors to show other engines in regular operation, outside of the exhibition, in order to determine satisfactorily the effect of use on the valves and other moving parts, and the reliability of the engines for continuous practical operation. It is intended that as far as possible all the engines shall be subjected to the same trials, under like conditions.

The exhibitors and the public will be free to inspect the instruments and records, only to such restrictions as will positively prevent unauthorized interference.

The experiments will be tried under the constant supervision of the superintendent, and of such of the judges as may be present.

The data concerning the trials will be collected by competent assistants appointed by the superintendent and approved by the judges.

4. At the conclusion of the experiments, the superintendent will make a full report of the facts demonstrated thereby, and transmit the same to the judges, together with the logs, records and diagrams upon which said report is founded.

All suggestions, statements and protests should be in writing and will receive careful attention.

(Signed) THOS. J. SLOAN,
HAMILTON E. TOWLE,
ROBERT WIER,
Judges Dept. V, Group 1, Division 1.

EXHIBIT F.

To the Exhibitors and others interested in the practical trials of steam engines:

GENTLEMEN:—The judges of Department V, Group No. 1, Division No. 1, desire me to personally conduct the experiments above mentioned, subject to such supervision as their leisure will admit.

Mr. F. W. Bacon will take the indicator diagrams and engine records. Mr. John Collins will note the dynamometer and boiler records. During the trials it is desired that every exhibitor in com-

petition should, of his own knowledge, know what is going on, and immediately report to me anything that is unsatisfactory. The power will be measured by the indicator and dynamometers.

The latter are in plain sight of everybody; the indices can be read with an opera glass, and the power calculated in a moment.

Mr. Bacon can, if he has leisure, furnish indicator diagrams to the exhibitors interested. The cost of the power will be ascertained by measuring the feed water with a meter, open to the inspection of all.

From the above, the number of pounds of water per horse-power can be ascertained at any time.

It is especially requested that all questions may be settled as soon as they occur, and that all interested will satisfy themselves on every point while the experiments are in progress, so that at the end, all will be willing to testify to the accuracy of the results.

Very respectfully,

(Signed) CHAS. E. EMERY,
General Superintendent Exhibition.

SUPERINTENDENTS' REPORT

OF THE

COMPETITIVE TRIALS OF STEAM ENGINES AT THE AMERICAN INSTITUTE EXHIBITION OF 1869.

American Institute Rooms, Astor Place,
New York, *November* 23*d*, 1869.

Messrs. Thos. J. Sloan, Hamilton E. Towle and Robert Wier, *Judges Department V, Group* 1, *Division* 1, *American Institute Exhibition of* 1869:

Gentlemen.—In accordance with the "Regulations for the Trials of the Steam Engines" entered for competition at the late exhibition, I hereby report in full the facts demonstrated by such trials, and transmit also the logs, records and diagrams upon which the report is founded.

My regular duties connected with the closing of the exhibition, prevented me from making the necessary computations until within the past twelve days.

This report has been written in such manner as to accomplish two distinct purposes, and therefore includes

First. Such record and statement of fact as it was my duty, as superintendent, to record and report to the judges, in accordance with article 4 of the Regulations of the Trial (Exhibit E); and,

Secondly. The report includes calculations and explanatory remarks which I have incorporated, by direction of the judges, as the facts and the results of their consideration of the same, become known from time to time.

Four engines were tested, viz.: An engine manufactured under the Corliss patent, by Mr. Wm. A. Harris, of Providence, Rhode Island; an engine of the Babcock and Wilcox patent, manufactured by the Hope Iron Works, also of Providence; an engine of the Rider patent, manufactured by the Delamater Iron Works in New York city; and an engine of the Loomis patent, manufactured by the Fishkill Landing Machine Company, of Fishkill, New York.

These engines were all of the horizontal, non-condensing type, and were each constructed with some form of the side frame, now so universally adopted. The chief differences consisted in the mechanism, by means of which the point of cut-off was automatically adjusted by the governor; also, the cylinder of the Babcock and Wilcox engine was steam jacketed, which was not the case with either of the other engines.

As is well known, the Corliss engine has independent steam and exhaust valves placed near the ends of the cylinder; the two steam valves at the top, and the two exhaust valves at the bottom. The valves are segmental, working in the bottom of circular valve chests, and are operated by rock arms on central spindles, which receive, from a vibrating plate, the so-called "wrist motion" peculiar to the Corliss engine. The point of cut-off is regulated by disengaging the valve by means of the governor, at any time before half-stroke, and closing it by a weight, checked, after a partial descent, by an air cushion.

The Babcock and Wilcox engine has a long slide valve working over ports, located in the side of the cylinder, and leading direct into the clearance at each end. The cut-off consists of two plates sliding over openings through the main valve, which plates are operated by the piston of a small steam cylinder. The cut-off takes place whenever steam is admitted to the small cylinder, and the time at which this occurs is varied by the governor, which changes the angular position of a small crank operating the valve of the small cylinder.

The Rider engine has also a common slide valve. The cut-off valve stem moves along behind and parallel with the main valve, and carries two cylindrical cut-off valves, the outer ends of which are cut on spiral lines. The back of the main valve is hollowed out in semi-cylindrical shape, to make a seat for the cut-off valves, and steam ports pass angularly through it, with the edges terminating on spiral lines corresponding to the ends of the cut-off valves. The latter receive motion from a separate eccentric, and the cut-off is varied by simply turning the cut-off stem a little, and thus changing the time at which the spiral ends of the valves meet the corresponding ports. This is done in a simple manner by the governor. Since the cut-off valves are moved in a longitudinal direction by the engine, the least force applied in a tranverse direction, by turning the stem, serves to direct the valve face from its direct course, and it moves over its seat in a diagonal line, on the principle of the composition

and resolution of forces. The governor, therefore, has perfect control of the valve, and the arrangement is remarkable for its simplicity.

The Loomis engine has four independent valves arranged like those in the Corliss engine. The valves however are conical, the faces and seats being perforated with a number of openings. The valves are operated by rods, connected to levers on the outer stem. An eccentric on a vertical spindle operates the exhaust valves and a cam on the same spindle opens the steam valves which are closed by springs. The advanced face of the cam is parallel to the axis of the spindle, but the rear face is in spiral form. The cut off is varied by the governor which raises or lowers the cam to allow the hemispherical ends of the operating rods to slip over the cam at different points of the stroke.

It was generally understood, at the opening of the exhibition, that a test was to be made of the engines, but complete preparations could not be made until the machinery was in position.

Many of the exhibitors were very tardy so that the machine department was hardly settled even as late as the first of October. As the time was becoming limited in which to properly test the engines, the chairman of the department of engines and machinery sent a note to the superintendent of the exhibition requesting him to ascertain what means were available for making the trial and report a plan of operation which could be carried out while judges were being selected. A copy of this note, of the report made in response thereto, and also of the approval thereof are each hereunto attached and designated exhibits A, B, and C, preceding this report.

In making preparations for the trials it was absolutely necessary that no material interference be made with the exhibition. To accomplish this required some little study.

The engines were placed side by side in the machinery arcade with wide passages between them, and as nearly as possible opposite the main entrance from the larger building. Two lines of shafting ran through the arcade, and a third parallel line was placed inside the main building. The engines all belted directly on the first line, which ran at 250 revolutions per minute. The two other lines were run at 140 revolutions.

The receiving pulley of each engine was made with a clutch so that either engine could do all the work, and allow the others to run also, simply keeping their clutch pulleys in motion.

There were two boilers of sufficient size to furnish steam for either

of the engines, and a system of double steam pipes was so arranged, that by adjusting the stop valves, either engine could be made to take steam from either boiler, while the other engines, steam pumps, &c., were supplied with steam from a common pipe connected to the other boilers. Flange unions were provided at each valve in the test pipe, so that blank flanges could be inserted when the actual trial took place, and thus prevent any question in regard to leakage of the valves.

Arrangements were made with the inventor of Neer's rotary dynamometer to place his instruments on the shafting to measure the useful work done.

The proper place for a dynamometer was upon the hub of the pulley which received the power direct from the engine, but the shafting opposite the engines was too large for any instrument then on hand, besides which it would have required a great deal of time to shift the machine from the receiving pulley of one engine to that of another. It was finally concluded to put up three dynamometers, two on the east shaft, at the ends of that portion of which extended in front of the engines, and the third on the driving pulley of the west shaft, which measured the work driven from that, and the third shaft in the other building. The result was very satisfactory. The power instead of being expanded in friction by the use of a large friction dynamometer, as would have been necessary some years ago, was transmitted and at the same time measured by the instruments used, and thus the trials and the exhibition were kept up together without interference.

The Harrison boiler proved tight on examination, and was for that reason selected to furnish steam for the experiments, and a Worthington meter was obtained and attached to the suction pipe of the pump feeding that boiler. The object of using a water meter was to positively prevent any tampering with the water measurement during the excitement of a trial.

The use of tanks would have required extra attention, and the frequent operation of a number of valves, liable to leakage and unauthorized interference.

As directed by you, a letter was posted in the engine room, addressed to the exhibitors, asking them to closely watch the trials, and stating that the instruments were so arranged that any person could keep his own record, and readily determine the results. (See exhibit F.)

A copy of the regulations for the trial (exhibit E) was also posted in the engine room.

During some preliminary trials, the load was found insufficient at certain hours of the day, and varied too greatly for a satisfactory trial. To remedy this, a pressure blower, on exhibition, of the Root patent, producing a positive blast by piston displacement, was fitted with wider belts, and the discharge orifice closed, so as to cause an additional resistance of eleven horse power. A five-foot Dimphel blower was also obtained (of the Novelty Iron Works), and after some delay, erected and put in motion at 900 revolutions per minute. This gave most satisfactory results. Working at full capacity, it furnished a resistance of about twenty-five horse power, and this could be reduced at will by simply closing the discharge orific.

During the trial all the machinery that the exhibitors would leave in our charge, was kept in motion steadily. Some of the exhibitors were so accommodating as to remain late at night to keep their machines in operation. With all the machinery and the blowers in motion, the indicator diagrams showed over one hundred horse-power. Of this, it was found that eighty horse power could be kept up steadily with the outlet of the large fan, partially closed, so that it could be opened to regulate the load when any machinery of importance was thrown off. Before commencing the experiments it was ascertained that the boilers and all their steam and water connections were perfectly tight, and the whole steam pipe was thoroughly felted. During the test of each engine all outlets in the steam pipe leading to other engines or pipes were shut off, not only by the valves but by putting blank flanges in the unions provided for the purpose. All surplus steam and water connections were cut off from the boiler, and the steam feed pump was, during the experiments, supplied with steam from the boiler of the Baxter portable engine. By these precautions it is certain that all the steam that passed through the engine was measured as water by the meter before entering the boiler. The tension of the dynamometer springs was carefully adjusted before starting, and to avoid all questions in regard to friction, the belts were removed from all of the engines except the one undergoing trial.

A log, or record, was kept of the experiments on which was recorded, every fifteen minutes, the pressure of steam and readings of the dynamometers. The revolutions of the engine were counted by an engine register, the reading of which was taken every half hour. The temperature and quantity of water used were recorded

every hour. Indicator diagrams were taken from both ends of the cylinder every fifteen minutes.

The representatives of the two rival engines from Providence, cordially accepted the invitation to watch the experiments, and accompanied my assistant in taking all the data. The dynamometer indices were on the level of the shaft, twelve feet from the floor, and were read with an opera-glass, which was passed from one to another, and by agreement no reading was recorded until all were satisfied of its correctness. By this means the official log corresponded exactly with the memoranda of the opposing exhibitors, no errors could occur, and collusion was impossible.

[The two engines from Providence were of the same size, and were run at the same speed. The results are, therefore, strictly comparable and are given in detail. The other engines were smaller and of different sizes, so the results possess less general interest, and are omitted in this publication.]

TABLE No. 1.

Showing the principal data from the records and diagrams kept and taken during the competitive trials of the non-condensing steam engines at the American Institute Exhibition of 1869.

	Babcock and Wilcox.	Harris.
TIME.		
a. Date of experiment, 1869	Oct. 25	Oct. 26
Duration of experiment, hours	8	8
ENGINE.		
b. Diameter of cylinder, inches............	16.00	16.13
c. Stroke of piston, inches	42.00	42.00
Proportion of piston displacement in clearances and ports	.015	.031
Total revolutions........................	28.965	28.931
d. Revolutions per minute	60.344	60.273
e. Mean steam pressure in main pipe, pounds	81.69	80.51
Mean initial pressure in cylinder per indicator, pounds	76.148	70.943
f. Point of cut off in fractions of a stroke per indicator, pounds......................	.189	.226
Mean terminal pressure in cylinder per indicator, pounds.......................	3.055	5.178
g. Mean effective pressure outb'd end of cylinder, per indicator, pounds	29.160	29.651
Mean effective pressure inb'd end of cylinder, per indicator, pounds	32.954	29.804

	Babcock and Wilcox.	Harris.
Mean effective pressure, both ends of cylinder per indicator, pounds.............	31.057	29.728
Mean back pressure (independent of cushion), per indicator, pounds	.800	.680
Mean friction pressure, per indicator, lbs..	2.848	1.786

DYNAMOMETERS.

Mean readings of dynamometers		Babcock and Wilcox.	Harris.
	North $(\times \frac{94 \times A}{200})$....H. P.	17.383	19.195 + .500 = 19.695
	Middle $(\times \frac{95 \times B}{100})$...H. P.	21.18 + 1.125 = 22.305	21.516
	South $(\times \frac{A}{100})$......H. P.	5.508	6.180
A	Revolutions of east shaft, N. & S. dynamometers	256.1	252.55
B	Revolutions of west shaft middle dynamometer	140.3	138.59

WATER.

		Babcock and Wilcox.	Harris.
	Difference of time for meter, hours	7.9847	8.0292 − .0453 = 7.9839
	Total water used in above time, cubic feet.	256.5	254.9
	Total water used during experiment, lbs.	16061.968	15964.376
p.	Water per hour, pounds...............	2007.746	1995.547

TEMPERATURES.

	Babcock and Wilcox.	Harris.
Temperature of feed water, degrees Fahrenheit.............................	47.0	47.0
Temperature of engine room, degrees Fahrenheit.............................	72.6	66.5
Temperature fire room, degrees Fahrenheit	42.7	49.7
Barometer, inches of mercury...........	30.95	30.29
Coal used during experiment,* pounds ...	2500.0	1957.5
Water evaporated, per pound of coal from temperature, above named, pounds.....	6.425	8.155

The principal data concerning the trials to determine the relative economy of the engines have been condensed in table No. 1.

* Not reliable, see text.

The experiments with the Babcock & Wilcox engine commenced at three P. M., but on account of a small misunderstanding in regard to the supply of steam for the feed pump, it was thought best to commence again at four P. M., after which the trial proceeded uninterruptedly for eight hours, until midnight. The trial of the Harris engine was commenced also at four P. M., and continued the same time. During this trial some of the instruments used gave trouble; for instance, the counter stopped working and had to be twice replaced, making it necessary to get the average revolutions from the time in which the registering took place. The hand indicating the power passing through the north dynamometer also dropped off and it became necessary to stop the engine in order to replace it. This was done without any loss of steam. The loss of time was estimated from the loss in revolutions shown by the counter. By this means the revolutions caused by the momentum of the parts in stopping balanced the extra steam required to put the machinery again in motion.

The details in table No. 1 are given more particularly than the judges may require, to enable the exhibitors who may see this report, to compare their own memoranda with the official record. For instance, in taking the readings of the meter, it was necessary that the water should be at the same height in the boiler in all cases. To accomplish this, strings were tied around the glasses of the water gauges, three and one-half inches above the bottom. The water was brought to this level as nearly as possible, at the end of every hour, the feed pump stopped, and the time noted in seconds. The reading of the meter was then taken and the pump again started. It was thus ascertained that the difference between the time of taking the meter at starting and stopping the experiments was, for Babcock & Wilcox, 7.98 hours, and for Harris 8.029 hours; but as the latter engine stopped .045 of an hour, the water was actually used in 7.98 hours. From this, the water used in eight hours was easily calculated. The dynamometers were designated, according to position, as north, middle and south. The mean reading of the dynamometers are given, to which are added, in some instances, the small correction required to bring their indices to zero after stopping. The readings of the middle and south dynamometers show the power due to a speed of 100 revolutions per minute, and the north instrument the power due to 200 revolutions. These readings must therefore be corrected by the actual speeds of the shafts which were

obtained by taking the revolutions of the engine from the register and counting the revolutions of each shaft during the same period of time. This gave the ratio of the speed of the engine to that of the shaft, and by the use of this ratio, the mean speeds of the shafts were obtained from that of the engine.

TABLE No. 2.

Summary of the Results of the Experiments made to ascertain the Economy of the Non-Conducting Steam Engines at the American Institute Exhibition of 1869.

		Babcock and Wilcox.	Harris.
a.	Duration of experiment, hours ...	8.00	8.00
b.	Diameter of cylinder, inches.....	16.00	16.13
c.	Stroke of piston, inches	42.00	42.00
d.	Revolutions per minute..........	60.344	60.273
e.	Steam pressure in main pipe, p'ds.	81.69	80.51
f.	Point of cut-off, in fractions of the stroke	.189	.226
g.	Mean effective pressure in cylinder per indicator, pounds.	31.057	29.728
	Distribution of the Power.		
h.	*Indicated horse power*	78.792	76.579
i.	Friction of engine, per indicated diagrams, H. P................	7.225	4.601
$j=h-i$.	Difference=gross load, H. P.....	71.567	71.978
$k=j\times.04$.	Extra friction of engine caused by load, H. P..................	2.863	2.879
$m=j-k$.	Difference { Net or effective horse pow'r Transmitted through belt.	68.704	69.099
n.	Dynamometer horse power.......	64.752	67.314
$o=m-n$.	Difference—Friction of connecting shaft*	3.952	1.785
	Water.		
p.	Feed water per hour by meter p'ds	2,007.746	1,995.547
q.	Steam per hour by indicator po'ds.	1,595.496	1,815.723
$r=\frac{100}{p}q$.	Percentage of water accounted for by indicator*.................	79.47	90.99
	Percentage of moisture present in the steam*..................	20.53	9.01

* See text.

COST OF THE POWER.

		Babcock and Wilcox	Harris.
s.	Water, per indicated horse power, per hour, pounds	25.482	26.059
t.	Water, per net horse power, per hour, pounds	29.231	28.880
u.	Water, per dynamometer horse power, per hour, pounds	31.007	29.645
$v=\frac{s}{9}$.	Coal, per indicated horse power, per hour, calculated from water, lbs.	2.831	2.895
$w=\frac{t}{9}$.	Coal, per net horse power, per hour, calculated from water, lbs	3.248	3.209
$x=\frac{u}{9}$.	Coal, per dynamometer, horse power, calculated from water, lbs.	3.445	3.294

Table No. 2 is a brief summary of the results of the experiments above described. The lines have been designated by letters for convenience of reference.

The mean power developed in the cylinder during each trial, in excess of that required to displace the back pressure of the atmosphere, is shown in line "*h*," marked "Indicated Horse Power."

The useful work done by each of the engines equals the power transmitted through its belt to the shafting, and must be obtained by adding to the dynamometer horse power, the power required to overcome the friction of the connecting shaft, which carried the receiving pulleys of all the engines. The friction of this shaft was *not* the same for the two engines. The belts of the engines were furnished by different exhibitors of belts, and tightened according to their differing ideas, which, under the circumstances of a general exhibition, could not be properly interfered with by either of the engine exhibitors or myself. For these reasons the belt of the Babcock and Wilcox engine was very tight, and that of the Harris engine, which was secured at the laps by cement only, was very loose, so much so, that it slipped a little when the load was being regulated for commencing the trial. In addition to this, also by the accident of position, the driving belt of the second line of shafting pulled almost directly opposite that of the Harris engine, and reduced materially the friction due to the tension of both belts. No such action took place when the Babcock and Wilcox engine was tried.

To ascertain the friction of the shaft under these varying conditions, each engine was in turn indicated when driving the connecting

shaft alone, and also with its belt thrown off. The difference between the two should have given the power required to drive the shaft when subject to the tension of the particular belt in use. In making this trial, however, the wishes of the exhibitors were regarded, and the diagrams taken with full boiler pressure in the steam chests, the regulation being performed by the governor, so as to take account also of the friction of the valves under the circumstances of regular working. The resulting diagrams were nearly all negative, showing that the indicator could not be relied on to measure the power at such extremely short points of cut off, as were required merely to overcome the friction of the engines. Upon discovering this, a new set of friction diagrams were taken by regulating with the throttle, and thus producing a more uniform pressure in the cylinder. The last of these were taken late at night, after the last of close of the exhibition for the season, so that there was no time to replace the belts and try the friction of the shaft in the same manner.

Having, however, both the indicated and dynamometer horse-power, the friction of this shaft in the two cases, has been found in another way, shown in "table No. 2," under the head of the "distribution of power." From the indicated horse-power (line *h*) is first subtracted the friction of the engine, per indicator (line *i*), and the remainder is the gross load (line *j*.) The extra friction caused by the transmission of this load would usually be reckoned at seven and a half per cent; but in these cases, I am satisfied that it was much less, for the reason that during the trial the lubrication was very well attended to. The low co-efficient of four per cent has, therefore, been used to obtain the friction of the load (line *k*), which is subtracted from the gross load, and the remainder (line *m*) equals the *net* or *effective horse-power*, transmitted through the belt, or in other words, the useful work done. From this is substracted the dynamometer horse-power (line *n*), and the remainder equals the friction of the connecting shaft (line *o*), which shows that, by *actual measure*, the friction of the shaft when the belt of the Babcock and Wilcox engine was in position, was much greater than when the belt of the Harris engine was in use.

Line *p*, shows the average amount of water per hour pumped into the boilers as measured by the *meter*.

Line *q*, shows the quantity of water used as calculated in the usual manner from the weight of the steam at the mean terminal total pressure shown by the indicator diagrams.

The specific volumes of the steam were ascertained from tables founded on the experiments of Regnault and others.

The facts required for this calculation are shown in "table No. 1," viz.: 1st. The terminal pressures from the indicator diagrams; 2d. The atmospheric pressure shown by the barometer (the total pressure equals the sum of the two), and 3d. The dimensions necessary to calculate the capacity of the cylinder, clearances, &c., at the termination of the stroke of the piston.

Line *r*, shows the per centage of the water used, which is accounted for by the amount of steam present in the cylinder at the end of the stroke. The deficiency in each case shows of course of the amount of *water* present with the *steam* at that point. A portion of the water was undoubtedly the steam condensed for the performance of the mechanical work, which was very nearly the same in the two cases. Under the head of "The Cost of the Power," are shown the water and coal required for the indicated, the net and the dynamometer horse powers. The coal required for the several kinds of power, as shown in the table (lines *v*, *w* and *x*), has been calculated from the water (lines *s*, *t*, *u*), on the assumption that the engine was supplied with steam from a boiler which would uniformly evaporate *nine* pounds of water per pound of coal. This evaporation is a fair result for a good boiler, and would have been produced by those used in the experiments, had the feed water been heated as in usual practice, and the evaporation uniformly equal to the result on the second day of the trial.

The accuracy of all the instruments used was tested either before or after the trials. The scales of the indicators were found to be as follows:

Right hand instrument	40	pounds per square inch.
Left " "	37.4	" "

The test of the dynamometers was very satisfactory, and was readily conducted by weighing the springs, measuring the distance run by them and the indices, and measuring also the distance from the center of the shaft at which the force was transmitted.

The meter was tested in place by running water through it into a barrel set on a scale. In these trials the water was so regulated as to pass through the meter at different velocities, so as to ascertain its *rate*, or the relation between the amount of water it actually delivered, and that shown by its register. There was no way of ascertaining the position of the pistons inside the meter except by

the slower movement of the first index of the register, and it required practice to stop that index exactly in the same place at all times; hence a wide difference between contiguous records may be due to imperfect manipulations, which would make no practical difference on the whole average.

The results of the trial are shown in the following table:

Number of test.	Reading of indices.	Number of cubic feet registered.	Net weight of water in barrel.	Weight per cubic feet registered.	Speed of meter.
	4181.1				
1	4185.1	4	229.00	57.25	Very slow.
2	4189.1	4	249.25	62.31	"
3	4194.1	5	279.50	55.90	"
4	4199.1	5	303.00	60.60	Slow.
5	4204.1	5	299.75	59.95	"
6	4208.1	4	250.00	62.50	Moderate.
7	4213.1	5	315.00	63.00	"
8	4218.1	5	315.00	63.00	"
9	4223.1	5	304.00	60.80	Slow.
10	4228.1	5	301.75	60.35	"
11	4232.1	4	251.00	62.80	Moderate.
12	4237.1	5	306.00	61.20	"

The first three trials were made at speeds *slower than the meter was ever required to run during the engine tests*, and might, therefore, be excluded. Their object was simply to find the maximum variation, the stream in one case being of less size than a common lead pencil as it issued without force from the end of the discharge pipe. The meter had openings two inches in diameter. The speed of the meter during most of the remaining six trials was slower than the average speed during the engine tests for the reason that the Croton "head" was too much reduced to deliver through the meter without the assistance of the pump much more water than an amount equal to that required during those experiments. The tests marked "moderate" in the last column show the rate of the meter during the trials of the engines. The meter had a different rate for every considerable variation in speed; but it *did not leak*, for the water delivered at the slowest speed weighed the least. At the slow speeds, therefore, the pistons did not quite complete their strokes. The maximum variation from the average of the last six tests was for a single one of the slow tests two and a half per cent. The others varied much less. During the trial, however, no such variation as this could have taken place, for it is well known that the rate of a meter is always the same at the same speed of discharge,

and the mean speed during the experiments with the two large engines was substantially the same. The exact difference may be calculated for the hypercritical as follows: One engine used 1995.5 pounds of water per hour and the other 2007.7 pounds, or six tenths of one per cent, more than the first. Now, the speed of the meter was at least required to be doubled or increased one hundred per cent to produce the difference in rate of two and a half per cent. So, since one hundred is to .6 as 2.5 is to .015, *the difference in the rate of the meter during the two engine experiments was fifteen thousandths of one per cent.*

An alleged misunderstanding in regard to taking into consideration the amount of fuel burned makes it necessary to discuss this point fully.

It was at first intended to measure only the dynamometer power and the water pumped into the boiler, so as to ascertain the amount of steam required to do the useful work. The reasons for this were that the indicated power would include the necessary friction of the engine, which could not be made available for a useful purpose, and the judges decided that the water could be measured during a short trial much more accurately than the coal. The boiler had forty-five square feet of grate surface, and the trials could conveniently last but eight hours, so any error of judgment in estimating the quantity of fuel on the grate bars or the cleanliness of the fires at the beginning or end of the trial would be a large per centage of the whole quantity of coal consumed. (See exhibit B.) The indicator power would, however, confirm the dynamometer power, and so also the coal burned should be proportioned to the water used, for water always takes up the same quantity of heat when evaporated from the same temperature, and like quantities of coal of the same quality will always furnish the same heat, and therefore evaporate the same quantity of water, which evident fact has been proved by the published record of numerous lengthy experiments.

In the original draft of the regulations of the trial (exhibit C), in order to form a ground for obtaining these confirmatory results if desired, it was stated that the engines *might* be indicated and the coal *might* be weighed. Before being signed by the judges, arrangements were made to indicate the engines and the fact was *expressly* stated in the regulations, while the wording as to the coal was not changed. On the contrary, by authority of the judges, the attention of the exhibitors was called to the instruments used during the trials

by means of a letter hung in the engine room with the regulations, in which was the following, viz.:

The cost of the power will be ascertained by measuring the feed water with a meter open to the inspection of all. (Exhibit E). The exhibitors gave their assent to this provision, and no protest was made during the experiments.

Notwithstanding the above facts, it became necessary to weigh the coal during the trials—*not* for the judges of engines—but simply to get at the evaporation of the boilers, as it was feared there would not be time to test the boilers after the completion of the engine tests. The coal account does not therefore properly belong in this report, still I do not feel at liberty to suppress any of the facts that took place at the time. The results showed that there was considerable more coal burned the first day than the second to evaporate substantially the same quantity of water. This may be explained in various ways. The necessary position of the fires and fuel made them at least liable to interested interference. It is not known that this fact was taken advantage of. If not, the result proves the difficulty of ascertaining the coal accurately in short experiments, and may be explained also from the fact that the boilers would easily make much more steam than was required, so the first day the attention of the firemen was very constantly occupied in regulating the steam pressure, and they were subject to less supervision also than afterward when all interested had become accustomed to observing the instruments in the main building. The result is useful as showing how great a difference can be made in the performance of a boiler by the simple management of the fires. The evaporation per pound of coal the first day was 6.4 pounds of water, an inferior result. The next day it rose to 8.2 pounds a very good result for any boiler using cold water. The third day the result was 7.7 pounds.

Attention is called also to the fact, that if the coal were not excluded by the conditions of the trial the results, it shows, stand unconfirmed by any other evidence and the quantity consumed, must for so short a trial be considered a kind of guess work. The meter, on the contrary, though varying its rate five times as much as one I saw tested for the Croton department, was at least, positively accurate, at the equal rates of speed during the experiments, as has been shown, besides which it has the confirmatory evidence of the indicator diagrams: for the engine which used a trifle more water by the meter had a lower terminal pressure in the cylinder, and by the usual

theoretical rules should have used less steam and fuel. (See lines *p.* and *q.*, table 2.) The fact that this engine did not use less weight of steam, corresponds with the known wet condition of the steam, as mentioned hereafter.

The trial between the Babcock and Wilcox and Harris engines possesses considerable scientific interest, from the fact that the cylinder of the former was steam jacketed while that of the latter was made direct from the Corliss patterns and without jacket.

The jacketed cylinder of the first named engine was surrounded by an air jacket, having a polished external covering. The Harris cylinder was clothed with felt, under a wood casing with the exception of the steam chests which were exposed and polished. The engines were of the same size, and as they were run also at the same speed the results are in every respect comparable.

The economy of these two engines is very remarkable. The best result possible by theory, for an engine working under the circumstances of this trial, is twenty-one pounds of water per indicated horse power per hour, and both engines approached this limit very closely.

To make this report complete, it is necessary to call attention also to certain prominent facts connected with the construction and management of the two engines.

The Corliss engine, built by Mr. Harris, was erected on a heavy, full length, deep laid foundation, was carefully finished and put in line and operated faultlessly, showing great mechanical ability in its manufacturer. The Babcock and Wilcox engine was erected on brick piers, and water accidentally got into the wheel pit and loosened this foundation, so that the engine moved considerably at every stroke.

After the trial, upon examination of the Babcock and Wilcox engine, it was found that, on account of a defect in the cylinder casting, the outer division of the valve face was too narrow by one-fourth of an inch, to cover the opening in the main valve. This defect admitted steam to the cylinder during the latter part of the expansion portion of the stroke, causing a prominent protuberance on the indicator diagram.

The steam supplied to the Babcock and Wilcox engine was quite wet during much of the time, as was observed particularly by one of the judges and other persons present. This can only be accounted for by the same differences in firing, or in operating the fire doors,

which caused the differences in coal. The steam was drier during the trial of the Harris engine. These observed facts are proved also by the meter and indicator measurement of the water (see lines *p* and *q*, table No. 2), for only 79.47 per cent of the water pumped into the boiler was present as steam in the cylinder at the termination of the stroke in the Babcock and Wilcox engine, while the Harris engine showed 90.99 per cent (see lines *r*). The deficiencies in the two cases show the amount of water present with the steam, and equaled, therefore, 20.53 per cent of the whole in the Babcock and Wilcox engine, and 9.01 per cent for the Harris engine.

The fly-wheel of the Babcock and Wilcox engine was evidently heavier than that of the Corliss engine. The difference in weight was estimated at 8,000 pounds.

The tables show the *actual results* of the trials, without any consideration whatever of the matters last mentioned.

The trials of the regulating apparatus of the engines were, from want of time, not made as full as was at first anticipated. In connection with one of the exhibitors, I had designed an instrument to register the speed, but it was not completed by the manufacturer. The regulation was tested by the judges and myself, by holding the governor out of position, thus increasing or decreasing the speed of the engine, and then suddenly permitting the governor to operate again.

All of the engines did well on this test; but the Harris and Delamater engines were particularly prompt in bringing the shafting again to speed.

The speed of each engine, when doing its work under different steam pressures, was tested, after its trial for economy, by running down the steam pressure until the speed of the engine slackened.

The results of these experiments are shown in the annexed table, in which two columns refer to each engine, and show the steam pressure and revolutions at the end of each minute during the trial.

	Steam.	Revolutions.
Babcock & Wilcox	62	61
Babcock & Wilcox	58	59
Babcock & Wilcox	54	58
Babcock & Wilcox	50	58
Babcock & Wilcox	45	58
Babcock & Wilcox	40	56
Babcock & Wilcox	37.5	53
Babcock & Wilcox	34.5	49

	Steam.	Revolutions.
Harris	74	60
Harris	70	60
Harris	65	60
Harris	62.5	60
Harris	59	60
Harris	56	59
Harris	52.5	59
Harris	48.5	58
Harris	45	58
Harris	42	58
Harris	38	58
Harris	34	57
Harris	31.5	53
Harris	28	50

There were two other engines in competition in addition to those mentioned, viz.: A vertical engine built at the Albany St. Iron Works, of New York, and having the Rider valve, and a Hicks engine of the new pattern. From the want of time, it was not possible to properly test these engines.

Respectfully submitted.

(Signed) CHARLES E. EMERY,
General Superintendent of Exhibition.

To the Managers of the American Institute Exhibition:

Gentlemen.—In accordance with the facts reported by the superintendent and observed by ourselves, we have come to the following conclusions (embodied in our report of December 3d, 1869), respecting the relative merits of the engines in question:

51. *Harris Steam Engine (Corliss), First Medal and Diploma.*

For best results on net effective power shown at the trial, being from one to two per cent better than any other in competition; and for superiority of workmanship and general arrangement of valves, and valve gearing.

848. *Babcock & Wilcox Steam Engine, First Medal and Diploma.*

For the most perfect automatic expansion valve gearing on exhibition.

The judges are of the opinion that, had the principles upon which

this engine was based been properly carried out in its construction, it would have performed much better. Also, it was evident during the trial of the Harris engine, the steam was drier than in the trials of the other engines.

Respectfully yours,

THOMAS J. SLOAN,
HAMILTON E. TOWLE,
ROBERT WEIR,
Judges Department V, Group 1, *Division* 1.

REPORT OF JUDGES
ON
PUMPS AND HYDRAULIC APPARATUS.

To the Board of Managers:

Gentlemen.—The undersigned, judges of Group 2, Department 5, submit the following as their full report:

Direct-Acting Steam Pumps.

In this division there were three competitors, to wit.:

No. 566 Steam Pump, Knowles & Sibley, Warren, Mass.

No. 729 Steam Pump, C. B. Hardick, Brooklyn, New York.

No. 755 Steam Pump, Geo. F. Blake, New York City.

These pumps are all of the class technically called direct-acting steam pumps, in which the use of a crank and eccentric are entirely dispensed with, the piston and plunger being attached to the one rod, and the motion of the steam valves taken from the action of the same.

At the Thirty-seventh Annual Exhibition of the American Institute, held in 1867, a practical test, by experienced gentlemen, was given to two, among others, of the pumps upon which we are now called to decide, to wit, the Hardick or Niagara pump and the Knowles pump. Inasmuch as the judges made a test at that time they were obliged to abide by such test and give their decision according to the facts developed.

In arriving at our conclusion, in the present case, we have not disregarded that test, but, on the contrary have given it full and careful consideration, and in view of it, and the *further* facts before us, our finding must necessarily be different from that of the judges at the said exhibition of 1867.

We desired to have a practical test this year, and especially so because a new direct-acting pump, at least one new to us, was in the list for competition, namely, the Blake pump. But we found that, in view of the lateness of the time at which we entered upon our

duties, and a lack of facilities, it would be impossible to have such test. Upon inquiry we found that Hardick did not claim that his pump of to-day is essentially different in construction from the one tested in 1867, and that of Messrs. Knowles & Sibley differed only in respect to an improvement whereby the pump valves could be reached in much less time. This then formed a basis to work upon in respect to these two pumps, and with the test of the judges at the 1867 exhibition (reported on pages 87–91, Transactions of the American Institute, 1867), and the two pumps at the present exhibition before us, we must decide in favor of the Knowles pump, as we shall presently show. But this test does not reach the Blake pump, we therefore decided to require of each of the three exhibitors a written statement of the superior qualities and points of excellence claimed for his pump, permitting comparisons to be drawn. Such statements were, in due time, furnished us, and to them we shall hereafter allude.

We will now consider the report of the judges at the exhibition of 1867. We find that the judges tested the pumps on *five* points: 1st. The first trial was to determine the relative economy of the pumps. On this trial the Knowles pump fell behind the Niagara, but this is easily and satisfactorily accounted for by the fact that the steam piston of the Knowles pump leaked badly; was "very leaky," as the judges expressed it. By examining carefully the construction of the piston, we find that the fault must have been due to accident, as the means provided by which the packing may be set out and kept tight is efficient in all respects. It was a fault in a particular pump, not incident to like pumps of the same makers; and the exhibitor of the Knowles and Sibley pump at the present exhibition explains this fully by saying that they had no pump made of the size required by the judges, and that they put the one which was tested together hastily. He says: "Our steam piston was left very loose, and, consequently, very leaky, simply through a misunderstanding, we supposing it had been properly adjusted at the factory, and the foreman at the works intending to have it adjusted here." We believe, therefore, that under ordinary circumstances, the two pumps must be considered equal in respect to their pistons, and as the test showed that the valves of the Knowles pump were tighter than those of the Niagara, due doubtless to the fact that the Knowles pump closes the exhaust port of its auxiliary cylinder at every stroke, we must decide that in daily practice the Knowles pump is superior, certainly equal, to the Niagara pump in economy of steam.

2d. The second trial was to determine the maximum rate of discharge. On the said trial the Knowles pump showed itself superior, delivering nearly as much water with a water-cylinder six inches in diameter as the Niagara did with a seven inch cylinder.

3d. The third test was to determine the minimum capacity. On the said trial the Niagara pump appeared superior, which, we are informed, was due to the fact that the two pumps did not have the same method of throttling the water discharge. We have ourselves repeated this test several times, and find the Knowles pump far superior to the Niagara, in fact, the Niagara pump would stop entirely when we attempted to run it very slowly.

4th. The fourth test was to ascertain the time required to show the pump valves. On the said trial the Niagara pump was far superior, but the Knowles pump has since such trial (1867) been improved in this respect, so that the valves are sufficiently accessible for any purpose, the openings are large and direct, and the valve seats may be readily reached for repairs, and various materials may be used for the valves so as to adapt them for pumping all kinds of liquors. We therefore consider that, taken as a whole, the pump end of the Knowles pump, is superior to that of the Niagara.

5th. The fifth test relative to the construction of the steam valves and piston, has already been referred to when discussing the first point. We will however add to what we have already said, that in our judgment the steam end of the Knowles pump, taken as a whole, is far superior to that of the Niagara.

We therefore consider that the Knowles direct-acting steam pump is, as at present constructed, far superior to the Niagara direct-acting steam pump, on every point made by the judges on the trial of 1867. In fact, it appears that whilst Messrs. Knowles & Sibley have improved their pump in the means of access to the water valves. Hardick has allowed his workmanship to fall behind, as evidenced by our test at slow speed.

We will now refer to the written statements or points presented by the exhibitors themselves.

Messrs. Knowles & Sibley claim for their pump

"1st. A perfectly positive valve either with water, air, or steam pressure." [Allowed. True, also, of Blake's pump. Not true of the Niagara or Hardick pump on exhibition.]

"2d. That our main valve is a plain slide valve, always wearing evenly and tightly, and is the best known and most easily repaired."

[Allowed. True, also of Hardick's pump, but not true of the Blake pump on exhibition.]

"3d. Superiority of style, design, workmanship and finish." [Allowed, though we find the Blake pump of a more compact design or pattern, the Niagara being quite the contrary.]

"4th. More costly material and consequent durability." [Not necessarily a peculiarity of this pump, though it appears to be a fact in respect to the three pumps in competition at this exhibition.]

"5th. Stronger and heavier parts." [Same remarks as to 4th."]

"6th. Larger suctions, discharges and inside ports than in any other." [Allowed, though substantially included in 8th point.]

"7th. Our valve seats are easily replaced when worn, while in the 'Niagara pump' the entire chamber is lost." [Allowed.]

"8th. We have a nearer direct course through large ports in our water end, and consequently less friction." [Allowed.]

"9th. Our steam and water piston packing is of best make and material, and can be expanded until entirely worn out." [Not necessarily a peculiarity of this pump.]

"10th. With our steam valve it is impossible to strike the cylinder head, and this is true of no other direct acting pump." [Allowed as to the three pumps on exhibition.]

"11th. Our maximum and minimum speed will compare with any, and much less wear at high speed." [Allowed as to first part.]

"12th. Should our steam valve ever become spoiled, the tappet arm will push over the valve, and thus perform the work. This is true of no other make." [Allowed as to first part, and as to second so far as we are at present advised.]

"13th. We reach our steam valve by removing four nuts only, while in the Niagara it is not only necessary to remove the water-chest cover, but also to disconnect the steam pipe." [The method of construction whereby the steam pipe is attached to the cylinder, is certainly a valuable feature in steam engines.]

"14th. It runs with the least noise." [Allowed over the Niagara.]

"15th. It is the only pump made with ground joints." [Allowed, we know of no other pump of this class in which *all* the joints are ground.]

"16th. It is the only pump made wherein the valves in large sizes are reached without the use of any tools." [Allowed so far as we are at present advised.]

"17th. It is the only pump made having a hammered (by hand)

copper air chamber on regular sizes." [This, we doubt not, is true of pumps furnished regularly for the market.]

"18th. Can run any speed without altering the valve motion." [Allowed.]

"19th. Can repair steam valve without removing the steam cylinder." [Allowed over the Blake pump.]

"20th. Have more patterns and sizes than any other maker, and make more sizes and styles than any other maker."

"21st. The price of this pump, notwithstanding its elegant finish, is no greater than that of any other first class pump, and fully twenty per cent below the price of some." [These two last points, twenty and twenty-one, we do not pass upon.]

The above are the points Messrs. Knowles & Sibley have furnished us in a condensed form, they are given in addition to a lengthy and interesting paper which we herewith inclose.

C. B. Hardick, although especially requested so to do, has failed to furnish us the points of superiority, in a condensed form, which he claims for his direct acting Niagara pump. Therefore, in order to exclude any claim of partiality against us, we beg to submit to your Board, as a part of our report, the *whole* of the subject matter of the paper he submitted to us on the subject:

"The superiority claimed for the Niagara Direct-acting Steam Pump is

"*First.* In the construction of its water chest, and the ease as well as rapidity of access to the valves therein in case of obstructions entering the same through suction, which in case of emergency, as on a vessel at sea, where there are occasions in which time becomes of vital importance, the valve-chest being fitted with a cap or cover at each side, resting on one bolt, there being no hinge or bolt in valves to hold them in position, as the construction of the water-chest is such that they are guided at each end, and held in position by the chest itself, the removal of either cap by unscrewing one nut, at once exposes all the valves for removal, examination, and cleaning openings of anything which may have entered to impede their operation. The valves are four in number and of composition, therefore are equally adapted for cold or hot water, or pumping acids and liquor, the chemical action of which, iron could not withstand; each valve has also a flat face on four sides, and in case of wear by long continued use, can be turned so that each face presents an accurately fitting surface to the valve seat, which also can be

readily faced by the simple process of filing. For mining or wrecking purposes, rubber valves of like form and construction may be used by simply inserting a metal bar through their center to keep the surface in position; the valves have just sufficient lift to pass the water, and are fitted with an elliptic removable spring on each valve, which spring, in case of rapid motion, insures the valve being closed at the proper moment. Another advantage in this form of valve is, that in case of accident, or, by any reason, a valve should be lost, or become unserviceable, its place may be temporarily supplied by a hard block of wood of like form and faced surface, and the pump will work right on in the discharge of its duty with equal facility as if the proper metal valves were in operation, thereby rendering the user in his emergency, independent of contiguity to machine shops."

"*Secondly*. For its arrangement of steam valve, whereby this pump will start at any point of stroke; it is further claimed that by this arrangement of steam valve that the pump will work, as has been practically demonstrated, submerged thirty feet under water, and, for this reason, is equally adapted to mining as for other purposes; it (the steam valve) being a cylinder, formed with or attached to an ordinary slide valve, with a stationary piston in the inside of said valve cylinder, the piston rod extending through covers at each end, and fitting steam chest so it cannot move, said covers being so arranged as to act as cushions for steam valve, steam being admitted to main valve by a small auxiliary valve through ports on same face or seat, connected with main valve, and which auxiliary valve is operated by the rock shaft connected to crosshead on side of pump; the under side of main valve being faced to correspond with valve seat on steam cylinder, by which, in case of wear, the valve and seat may readily be refaced.

"*Thirdly*, In importance, is the fact, as a matter of economy to those who use steam pumps, that this pump is cast, as far as possible, in separate parts; while, at the same time, it retains the utmost simplicity and durability of construction. It frequently occurs, by reason of accident, and especially in cold climates by the action of frost, some part of a steam pump will crack, or otherwise become worthless, when, by reason of this pump, being cast in separate parts, to such an extent that the immediate part affected only becomes worthless, and can be replaced at much less expense than if there were a less number of pieces, it becomes a matter of saving, and consequently of very great importance to the purchaser."

"Its water cylinder being lined with composition, as well as its valves and valve-chest being of the same material as also its metallic or ring packing renders it at once a serviceable pump for salt as well as fresh water, for either hot or cold water, beer or oil, or for acids and liquors, the chemical ingredients of which will admit of no other practicable composition."

Geo. F. Blake claims superiority for his pump in the following respects:

"1st. Simplicity in the arrangement of parts, the piston valve, tappet arm, piston water, plunger, and water valves, being all the moveable parts, can be removed without in the least interfering with each other." [Allowed.]

"2d. Hollow plunger valve having double the capacity for exhaust steam as for inlet, keeping both exhaust ports open all the time." [This point is well taken, but such a valve is, in our opinion, liable to leakage.]

"3d. Cut-off port, by which the slide valve cuts off the steam each stroke, preventing waste of steam and pounding under high speed." [The point as to waste of steam is allowed over Hardick. All other pumps have adequate means for preventing pounding.]

"4th. Auxiliary exhaust port, which connects the main steam port, and takes the pressure from the cylinder through the slide valve into exhaust port, which motion is prior to the movement of the plunger valve, again prevents pounding under high speed." [Allowed as to last part.]

"5th. Cushioning plunger valve, by closing its own exhaust, holding the confined steam as a cushion, then taking steam under spring valve, simple and effective under any pressure." [Allowed.]

"6th. Positive motion of plunger valve, holding it at either end of stroke by direct steam, making it impossible to center the pump by reason of the valve working back, as in the case of pumps using exhaust steam for this purpose." [Allowed.]

"7th. Reducing speed in slide valve, which arrangement also admits of a short connection between the steam and water cylinder, as without regard to stroke no greater is required than will give access to the stuffing boxes." [Allowed.]

"8th. Casting the steam cylinder and plunger cylinder in one piece. No one thing has caused so much difficulty as the leakage of steam between the ports. This arrangement is a perfect remedy, and, we claim, is the most valuable improvement in any patent yet issued

in connection with steam pumps." [The feature stated is found in the pump; and it greatly simplifies the construction, but is liable to the objection that an injury to or breakage of either cylinder destroys both."]

In conclusion, we submit it to your honorable board that we have shown not only by the practical test of 1867, as applied to the pump of Knowles' and that of Hardick at this exhibition, but by the "paper showing" of the parties themselves, that the Knowles direct-acting pump of to-day is superior in all respects to the Niagara direct-acting pump, not only for general purposes, but as a boiler feed. We therefore recommend that a first premium be awarded to Messrs. Knowles & Sibley for the best direct-acting steam pump.

And finally we must state that we hardly feel authorized in deciding that the Blake is superior to the Niagara pump, although it possesses several features which make it, like the Knowles pump, superior in some respects to the Niagara pump, and though it possesses the feature of compactness which makes it superior in one respect to both the Knowles and Niagara pumps. We sincerely regret that Mr. Blake's pump could not have had a practical test similar to that of 1867, adding however a test for *all* the pumps as to their capability for lifting water; but inasmuch as it was not subjected to a competitive test of this nature, we cannot innovate with a paper showing upon the rights of the two pumps which have heretofore been subjected to such a test.

We, therefore, recommend that a second premium be awarded to C. B. Hardick for a superior direct-acting steam pump, and that a third premium be awarded to George F. Blake for a superior direct-acting steam pump.

STEAM CRANK PUMPS.

In this division there were two competitors, to wit:

No. 729. *Crank Pump and Engine Combined.*—C. B. Hardick, Brooklyn. N. Y.

No. 950. *Woodward Steam Pump.*—Woodward Steam Pump Manufacturing Company, New York city.

These pumps were of the class which change a reciprocating into a rotary motion by means of a crank.

C. B. Hardick furnished us with a lengthy written statement concerning his "crank pump and engine combined," better known as the "Niagara crank pump," from which we cull and allow the following points of excellence:

First—In the construction of its water chest, providing easy and quick access to the water valves in case of obstructions entering the same through suction.

Second—In the water valves, which may be made of any material best adapted for pumping different liquids, and which may be readily faced and inserted and withdrawn.

Third—In the means of securing the bonnets to the water chest, whereby the water valves may be reached and the bonnets replaced in less than a minute.

Fourth—In the method of combining the steam end with the water end, whereby the latter may be disconnected from the former and a complete steam engine provided, thereby furnishing power for driving machinery, hoisting and for other purposes where power is required aside from that of pumping, the connecting and disconnecting being effected with great facility and expedition by simply unscrewing one nut, by which the piston rod of the pump part is connected with the cross-head of the engine.

Fifth—In constructing the pump and engine in separate parts, so far as compatible with durability and simplicity, thereby greatly reducing the expense of repairs in case of accident, frost cracks, &c., &c.

The Woodward Steam Pump Company failed to furnish us with a full and concise statement, as required.

Upon examination we find the Woodward pump, so long and favorably known to the public, to be very efficient, strong, durable and well finished; but the means for permitting access to the water valves is not so good as in Hardick's pump.

We therefore recommend that a first premium be awarded to C. B. Hardick for the best steam crank pump, and that a second premium be awarded to the Woodward Steam Pump Company for an excellent steam crank pump.

DRAINAGE PUMPS.

Under this general head we have classed the following:

No. 532. *Anti-friction Centrifugal Pump.*—W. D. Andrews & Brother, New York city.

This pump has attained a national reputation, and considered in connection with the Gwynne pump (manufactured in England), of which it may be regarded as an off-spring, its value as a wrecking and drainage pump is conceded throughout the world. There is little attempt at economy in steam in the means furnished for operat-

ing this pump, but its great capacity for elevating and discharging large volumes of water in cases of emergency, where the consumption of steam is a matter of secondary importance, warrants us in recommending for it a first premium.

With regard to the central discharge centrifugal pump, exhibited by the same firm, under the same number (532), we consider that the points of resemblance between this more modern pump and the Gericke pump are too numerous to permit our directing special attention thereto.

No. 134. *Turbinate Force Pump.*—J. H. A. Gericke, Jersey City, N. J.

The construction of this pump is quite similar to that of the Jonval turbine. The parts are well designed, and not liable to derangement from the entrance of foreign substances. We consider it a very efficient pump, and recommend the award of a first premium, as the best turbinate force pump offered to the public.

No. 474. *Mining and Wrecking Pump.*—Continental Iron Works, Greenpoint, L. I.

The extreme simplicity of parts displayed in the construction of this pump, and the facility with which the scroll wheel can be withdrawn without disturbing the surrounding case or the driving belt, are features that must recommend it to all engaged in mining and wrecking pursuits. We regret that lack of time prevented our having an experimental test of both this and the Gericke pump. We however recommend for this a first premium as an exceedingly simple and desirable form of rotary pump.

No. 589. *Steam Pumping Engine.*—P. S. Justice, Philadelphia, Pennsylvania.

This device is of the construction technically known as a "diaphragm pump." The arrangement and method of operating the steam valves appear to us to be novel and ingenious; but the steam is separated from the water by a diaphragm only, and must therefore be subject to considerable condensation, and therefore there is a lack of economy. One of the greatest difficulties in the construction of this class of pumps is to obtain a reliable and durable diaphragm, and as to this feature in the present pump we are not advised. In cases where it is desirable to have a pump possessing no rubbing surfaces, for instance, one for pumping dirty or gritty water, this one we doubt not would be found desirable and efficient. We recommend for these exhibitors a second premium for a steam pumping engine.

Feed Pumps.

No. 523. The Positive Feed Pump of J. W. Cole, New York city, combines so many of the features of a good boiler feeder, occupies so little horizontal space, is simple in the arrangement of its parts, and so well calculated to prove durable, that we recommend for it the award of a first premium as a reliable vertical feed pump.

No. 1206. Messrs. Wm. Sellers & Co., of Philadelphia, are, in our opinion, deserving of a first premium for an injector of great excellence, of unsurpassed workmanship, and one which has been thoroughly tested by long public trial.

No. 564. The rotary steam pump of Messrs. H. C. Dart & Co., of New York, in our estimation excells all others of its class in extreme simplicity of the moving parts, uniformity of action, and great freedom from unnecessary friction. We recommend for it a first premium as a Rotary Boiler Feed.

No. 179. *Factory Pump.*—Bridgeport Manufacturing Company, Bridgeport, Conn.

This pump is constructed upon the same principle as that in the American submerged pump, made by the same manufacturers, and is necessarily efficient. The pump however is constructed as a suction and force pump to be driven by a belt. It is properly termed by its makers, a factory pump, and we recommend that a second premium be awarded its manufacturers for a factory pump.

Hand Pumps.

Under this general head we class a number of pumps, which are intended more especially to be operated by hand power.

No. 475. *Sink Pump.*—James Coleman & Co., New York City.

This is a brass barrel lift pump, especially adapted for use in a sink. We are unable to discover any feature in the pump which makes it superior to other pumps of the same character now in the market.

No. 179. *Sink Pump.*—Bridgeport Manufacturing Company, Bridgeport, Conn.

This a novelty in the way of a pump. Its barrel or cylinder is made of glass, which is supported in a slotted metallic frame. Such cylinder permits the valve and plunger to be at any time inspected without taking the pump apart; it also enables one at a glance to discover whether or not, in freezing weather, the water has been allowed to escape from the pump, by the tripping of the valve in the usual way. The glass cylinder also very materially reduces friction,

and is free from liability to corrosion. The pump is also provided with a swivelling handle. We recommend for this pump a first premium as the best sink pump.

No. 475. *House and Ship Pumps.*—James Coleman & Co., New York city.

These were a number of well finished pumps, of the class usually employed for forcing water up in houses above the head of the aqueduct water. The pumps were not in operation, and we did not discover that they were materially different from pumps of this class now in the market, made by other manufacturers.

No. 179. *The American Submerged Pump.*—Bridgeport Manufacturing Co., Bridgeport, Conn.

We were highly pleased and entirely satisfied with the construction and operation of this pump. It is a double acting lift and force pump, adapted for use in wells and on ships. We carefully tested one of these pumps, to determine its merits relatively to other lift and force pumps. We found that with a one-inch discharge pipe the pump would deliver twenty gallons of water per minute, from a depth of fifty feet, when operated with but one hand, and that with a three-eighth inch nozzle it would throw a solid stream of water seventy feet in the air. Its efficiency as a ship pump is beyond question; and as a farm pump, for watering gardens, lawns, washing carriages, &c., &c., it is unsurpassed. The pump consists of few parts; there is a hollow piston cast in one piece, and two metal valves inserted through openings at opposite sides of the piston, the discharge pipe is screwed into the piston, and the piston is placed in a double chambered pump cylinder, each chamber being provided with a puppet valve, and in this way water is supplied above and below the piston, and hence the pump is double acting, and discharges a continuous stream. The parts are artistically finished and well fitted, and no packing is employed save when the pump is to be used as a suction pump, as may sometimes be desirable; in such case, packing rings, expanded by water pressure, are used. The exhibitors claim for this pump "great power, simplicity of construction, durability, ease of action, and that the pump is a positively non-freezing pump," and we are pleased to allow these claims in full for this efficient pump. We recommend that the exhibitors of this pump be awarded a first premium for the best force, ship and well pump.

No. 385. *House and Ship Pump.*—W. S. Carr & Co., New York city.

The exhibitors claim for this pump "adaptability" inasmuch as it may be stationary or secured to a plank and be portable, and used as a house and ship pump; "durability," a brass cylinder being used, "efficiency," "simplicity," "cheapness." Upon an examination and trial of the pump, we find that it possesses many excellent features, and recommend that its exhibitors be awarded a first premium for the best house pump.

No. 643. *Force Pump.*—J. D. West & Co., New York city.

This pump is very efficient in its action, simple in construction, and well guarded against danger from freezing, but we regard the one (No. 179), for which we have recommended a first premium as more justly entitled to the same.

No. 892. *One Deep Well Pump, one Self-acting Pressure Pump.*—Thomas Hanson, New York city.

These pumps were not in operation, and we were unable to discover in them any qualities of marked excellence.

No. 918. *One Large Lever Forcing Pump.*—John P. Gruber, New York city.

This is a double acting force and lift pump, two cylinders are employed. We were not favorably impressed either with the construction or operation of this pump.

No. 335. *The Union Pump.*—Andrew Fitzpatrick, New York city.

This device though entered under the title of pumps, appears to possess no novelty, except as to the mechanism employed for operating the pump piston. This mechanism consists in a combination of hand and toggle levers whereby great power is obtained. Such mechanism may be highly useful to operate an air pump where the load increases toward the completion of the stroke; but this feature is not necessary in an apparatus for pumping water, which, if well made, would have a substantially constant load throughout the stroke.

No. 658. *One Force Pump; two Barrel Pumps; one Well Pump.*—Emery Rotary Machine Company, New York city.

These are pumps of a novel and ingenious construction, and they operate efficiently. We recommend that these exhibitors be awarded a first premium for the best rotary pumps for domestic use.

No. 332. *Metropolitan Garden Pump.*—Jules Cheron, New York city.

This is a most convenient and desirable apparatus. It consists of a cylindrical reservoir or tank mounted on wheels to which is applied a force pump. The device is designed to carry its own supply of

water, but the supply failing, the pump may be used for lifting and forcing water from a cistern or well. It is a very simple apparatus. We are informed by the Superintendent of the Exhibition that one evening a sign thirty-five feet above the floor caught fire, and that with one of these pumps, which stood near by, with its tank of water, he quickly extinguished the fire, thereby preventing perhaps a dangerous conflagration. We recommend that a first premium be awarded to the exhibitors of this device for the best portable garden pump.

Fire Engines.

No. 554. *Steam Fire Engine.*—Cole Brothers, Pawtucket, R. I., in our opinion deserve a first premium for the superior excellence in design and workmanship displayed on their steam fire engine No. 2. By employing a vertical steam cylinder, they secure a compact arrangement of the parts, prevent irregular wear of the piston, and obtain an engine that will remain stationary without blocking under the wheels. The forging of the piston and pump rod from one piece of metal is a desirable feature in the use of the slotted cross-head and allows of a very firm attachment of the latter, thus avoiding the danger of the slide block being cramped under any circumstances. The valves of the pump can be examined with the greatest ease. The suction pipe is bent with a syphon curve, giving an easy flow of the water to the pump, and the universal testimony of the various owners clearly points to its marked ability for drawing water from deep wells. The general workmanship is of the highest order, and the finish is a matter of most careful study.

No. 54. *Model Fire Engine.*—Geo. Chavell, Bloomingdale, N. Y. A *most absurd* toy that should never have been permitted to pass inside the gate of the exhibition.

Water Works.

No. 26. *Perpetual Self-acting Water Elevator.*—Philip Weck, Brooklyn, N. Y.

Mr. Weck's invention makes use of a force to which comparatively little attention has been successfully directed. The device is very ingenious. We regret having had no opportunity of seeing it constructed upon a large scale, and of examining it in operation.

Nos. 923 and 924. *Water Works.*—John P. Gruber, New York city.

We regard this device for elevating water to the upper stories of

dwellings as worthy of most careful consideration from architects, builders and capitalists. If properly constructed it will result in a great saving of water, relieve dwellings of the severe strain caused by large tanks, and tend to preserve the integrity of the plastering on their walls. We recommend that a first premium be awarded to the inventor.

Ale Pumps.

No. 470. *Four-Pull Ale Pump.*—Byrnes & Bryan, New York city.

No. 493. *Six-Pull Ale Pump.*—J. M. Whitfield & Son, New York city.

The above ale pumps were examined with care, and although there were many points of marked excellence in each, yet we were unable to discover any special reason for awarding a premium, as there existed such a strong resemblance between these and all others of their class. The pump of Messrs. Byrnes & Bryan, in our opinion, excelled in superiority of workmanship. The silver mountings were all hand plated and fitted with great care to the wood work, in such a manner that no dirt could pass under, or cloths catch in the cleaning of the surface. The stroke of their pumps was a inch greater than that of their competitors, so that one-sixth more ale could be lifted at each pull of the handle. The leverage being changed, of course the lift involves a little greater exertion of power. A flush sill is convenient for entering and withdrawing the mug or measure from the faucet. It was noticeable that all their silver work had a smooth finish, and consequently could be more perfectly cleaned. The attachment of the pump levers was very mechanically arranged for obtaining strength and safety from accident.

Turbine Wheels.

No. 586. No opportunity was offered for viewing the Turbine Wheel "Monitor" (exhibited by P. Fields & Sons, Jersey City, N. J.), in practical operation, but on close inspection we were much pleased with the mechanism of the gates. They very effectually distribute the water uniformly upon the buckets, are guarded against any stoppage of all the gates, from the entrance of foreign substances through one, are hung in such a manner that the effort required for closing is substantially the same at all positions, besides the full benefit of the head is secured, irrespective of the width of the openings. In addition to those advantages, the method of distribution

is eminently calculated to impart a steady, uniform motion to the wheel. We commend it to your consideration as worthy of a first premium.

HYDRAULIC GAUGE.

No. 490. *Hydraulic Pressure Gauge.*—Thos. Harbottle, Brooklyn, N. Y.

An excellent gauge; but there are many others in the market equally meritorious.

BLOWERS.

No. 1142. *Pressure Blower.*—B. F. Sturtevant, Boston, Mass.

We examined this blower with much care, and were highly pleased with the general excellence of the design, the *careful* study bestowed on the parts, and the superior mechanical skill displayed in the manufacture. While we recognized the fact that the perfect fit of the fan, in conjunction with the curvilinear form of the case, renders possible a much higher pressure than can be procured from fan blowers of ordinary construction, we are unable to class it among what are popularly termed "pressure blowers," but consider that it occupies an *intermediate* position between a simple fan and a positive pressure blower. To particularize the many desirable features in their design, would be tantamount to giving a description of all the parts, a subject too extended for the narrow limits of our report. We recommend that a first premium be awarded to Mr. Sturtevant, for a fan blower.

No. 418. *The Multiple Fan Blower.*—P. Clark, Rahway, N. J.

This blower justly attracted much attention. The inventor has aimed to accelerate the speed of the blast delivered from the ordinary fan blower, by passing the air successively through two or more similar blowers, and finally discharging it from the last under a pressure as many times greater than its initial as there are distinct blowers in the combination. That he has accomplished the same, was abundantly proved by a careful test to which the blower was subject. One of the blowers, composed of four separate compartments, containing as many fans on one shaft, was operated at a fair speed of 1,500 revolutions per mimute, whereupon several attached syphon gauges indicated pressures corresponding with two, four six and eight inches of water. The belt was then throw off, the first three compartments with their fans removed, and the remaining fan operated in its case, at the same speed as before. The gauge under these circumstances indicated two inches depression, conclusively showing that the pres-

sure was increased in proportion to the number of the blowers through which the air was obliged to pass.

It was a matter of regret to the committee, that their time proved too limited for a test of the relative power required under the different conditions of work. With the ability thus to augment the intensity of the blast, by the attachment of more blowers, the inventor secures the desideratum of a slow speed of the fans, and consequently diminished wear of the parts. We earnestly recommend the award to Mr. Clark, of a first premium, for a "multiple fan blower."

No. 804. *Rotary Blower.*—S. S. Townsend, New York city.

We were thoroughly impressed with the peculiar excellence of these machines. We consider them superior beyond comparison to any fan blower extant, and to excel in economy and efficiency all others of their own class. From the nature of the case, a fan blower can produce only a comparatively weak and inefficient blast, which has a strong tendency to succomb when determined resistance is made to its progress. Consequently at the very moment a positive and vigorous blast is required it is found that the momentum of the air grows weaker and weaker, while the fan continues its revolution without any effective result, but at the same time it does not fail to make heavy and expensive draughts upon the motive power. This inefficiency is specially observable in metallurgical operations, for when the charge of the furnace is low, the tuyeres are very apt to become clogged, and the greatest effort of the blast is required to keep them free, so that the melting may continue until all the metal has been drawn off. The rotary blower not only overcomes this difficulty, but also effects a great saving in power, and wear and tear of the parts. Its superiority over others of its own class lies in the fact that the impellers work in no other lubricator than that of the surrounding air. The surface friction is consequently a minimum. The duplex arrangement of the gearing and driving belts prevents all unequal strain, and the system adopted by the makers in the fitting up of the parts, insures great durability in the structure. By comparing the rotary blower with blowing cylinders, it will be seen that the comparatively high speed of the former (100 to 300 revolutions), renders an equalizing receiver unnecessary, besides effecting in other respects considerable economy in the first cost of the machinery. The hand blower for smithy purposes is exceedingly compact and admirably adapted for the purpose for which it is intended. For the fore-

going reasons, we recommend that a first premium be awarded Messrs. P. H. & F. M. Root, the inventors, for the best rotary pressure blower.

HOSE COUPLINGS.

No. 958. *Patent Hose Coupling.*—Gaylord Coupling Company, New York.

We have carefully examined and experimented with this coupling to satisfy ourselves as to its security, as to its being liquid tight, and and as to the time required for connecting and disconnecting hose pipe with it. We are satisfied that it is secure against accidental derangement, such as might occur in the dragging of hose pipe at fires; that it is reliable as to being water tight, and that with it hose can be coupled and uncoupled with great ease and rapidity. We recommend that the exhibitors be awarded a first premium for the best hose coupling.

No. 1162. *Empire Coupling.*—Taylor & Courtlandt, New York city.

We have also carefully examined this coupling. It appears to be reliable as to being a liquid-tight coupling, but we were not impressed with its security against its being deranged when subjected to the rough usage of a fire department. As a coupling for stationary pipes we have no doubt of its efficiency, and we therefore recommend that the exhibitors be awarded a second premium for a hose coupling.

HOSE PIPE NOZZLE.

No. 957. *Patent Adjustable Double-jointed Hose Pipe Nozzle.*—W. D. Tewksbury, New York city.

We were not satisfied as to the necessity of a universal jointed hose pipe nozzle of this character. It might be useful in a cramped place, where it would be difficult to move the hose pipe, so as to direct the stream in any given direction; but we think a person would need considerable practice to use the device properly, as, without care, he would be likely to direct the stream upon himself as upon any other object.

HOSE PIPE SPRINKLER.

No. 959. *Hose Pipe Sprinkler.*—W. H. Haight, New York city.

This hose pipe nozzle is so constructed that by turning, in greater or less degree, a milled nut at the end of the nozzle the flow of water may be entirely stopped, or caused to emerge in a solid stream, or

caused to emerge in spray for sprinkling plants, etc., thus combining three useful features in a hose pipe nozzle for domestic use. We recommend that the exhibitor be awarded a second premium for an improved hose pipe sprinkler.

Hose.

No. 1081. *Linen Hose.*—New England Manufacturing Co., Boston, Mass.

Upon examination we find this hose to be a very fine article of its class, and worthy of a second premium.

Lubricators, Oil Cups, &c.

No. 175. *Case of Lubricators, Oil Cups, Bibbs, Valves, &c.*—Broughton & Moore, New York city.

The display of lubricators, oil cups, bibbs, valves, &c., was highly creditable to this establishment. In regard to this oil cup, we find that it is capable of the most accurate adjustment, and the glass reserving at all times exhibits the height of the supply. We recommend that these exhibitors be awarded a first premium for the best positive feed oil cup on exhibition.

No. 216. *Oil Cup.*—A. W. Harris, Providence, R. I.

We were much pleased with this oil cup, and fully appreciated the superior manner in which the regulating stem is supported. But the reservoir was not made of glass, and we consider this a very desirable feature in oil cups, as it is a guard against carelessness on the part of engineers.

No. 540. *American Oil Feeder.*—J. B. Wickersham, Philadelphia, Pa.

This oiler conveys the oil, by means of a wick braided upon a wire, from the reservoir over a tube which extends nearly to the top thereof, and down through the same to the journal. The size of wick used regulates the quantity delivered. Written evidence presented to us from users of the oil cup, shows that the oil cup will deliver "an ounce of oil in one month, or an ounce in a year," and hence it is called by its inventor a "Graduated Oil Feeder," and styled "The American Oil Feeder." A large number, over fifty, of these oil feeders were applied to the shafting, and used during the entire time of the exhibition this year, and we learn that they gave entire satisfaction. We recommend that a second premium be awarded John B. Wickersham for "The American Oil Feeder."

No. 838. *Lubricators.*—Holland & Cady. New York city.

This is a regulating feed oil cup, and is provided with a glass reservoir. A tube passes up a certain distance in the reservoir, and is provided with a through and through perforation for admitting the oil to the tube; a thumb screw is arranged at the top of the tube, and the flow of oil into the tube is regulated by contracting the diameter of the perforations by means of this thumb screw. It is necessary to remove the tube from the reservoir whenever this thumb screw is to be operated, in order to regulate the quantity of oil delivered, and this is an indispensable feature in an oil cup.

No. 674. *Lubricator.*—Nathan & Dreyfus, New York city.

This is an automatic oil cup; it is provided with a tubular stem, into which is placed a rod, which is caused to rotate during the revolution of the journal, and *work down*, as it were, the oil. The size of the rod regulates the quantity delivered. The delivery of the lubricating liquid is not kept up whilst the journal is at rest. The reservoir is of glass alone, or of glass protected by a slotted metallic frame. This lubricator is in general use throughout the country, and is spoken of in the highest terms.

We recommend that a first premium be awarded to Messrs. Nathan & Dreyfus, for the best automatic lubricator.

No. 972. *Patent Oilers.*—James E. Granniss, New York city.

We do not regard these oilers as superior to many others in the market.

TUYERES.

No. 464. *Hot Blast Water Tuyeres.*—J. Bayliss, New York city.

Mr. Bayliss' arrangement of tuyere is well calculated for the requirements of a hot coke fire. But a central-blast tuyere is so much better adapted to both large and small work, requires but little attention, is durable, and has its blast heated by the hot coals which drop within, that we cannot see any just cause for recommending this tuyere to the public, as being superior to all others.

AIR PUMPS.

Nos. 921 and 922. *Air Pumps.*—John P. Gruber, New York city.

Upon due examination and trial, we found these air pumps to be simple and very efficient, and eminently worthy of favorable consideration.

No. 368. *Air Pumps.*—James Coleman & Co., New York city.

We found this to be a very efficient device, and gotten up in elegant style and finish, sustaining the reputation these manufacturers have for artistically finished work.

Respectfully submitted.

WM. S. AUCHINCLOSS.
M. M. LIVINGSTON.
J. S. GRIFFITH.

REPORT ON LOOMS.

To the Board of Managers:

GENTLEMEN.—The undersigned, judges in department five, group five, report that they have carefully and impartially examined the several competing articles submitted to them. The best article of those intended to accomplish the same object is mentioned first, and the remaining articles of the same class in their relative order of merit. While we have deemed it unnecessary to point out what seemed to us defects in any article, we have, on the other hand, stated in brief terms the commendable qualities in those which have received our highest approval, which are not only the best on exhibition, but equal or better than any elsewhere known to us.

Nos. 548 and 596. *Positive Motion Power Loom.*—The Positive Motion Power Loom Company, 35 and 37 Wooster street, New York.

In this loom the shuttle is carried through the warp by a positive motion upon a carrier very ingeniously arranged to throw no strain or friction upon the warp threads. Its advantages are that it enables cloth of *any width* to be woven as readily as narrow goods. It produces a superior selvage, because of the even manner in which the weft is deposited, and that a strain is kept upon the weft thread until the reed beats it home. It enables the finest silks to be woven by power at a high speed, and it removes all liability to serious "smashes" common to the ordinary flying shuttle. We consider this a very important improvement, and one worthy the highest award.

No. 207. *Three Circular Looms.*—Palmer & Kendall, 158 Chatham street, New York.

There are three of these looms exhibited, each doing a different class of work. Their main features are a gravitating shuttle, revolving warp and stationary track or pattern cylinder producing the "shed." By changing the arrangement of grooves of this cylinder any character of fancy weaving may be produced. The machines are ingenious, well built, and do excellent work of a character peculiar to itself. We believe it to be a valuable improvement.

REPORT ON SEWING MACHINES.

No. 578. *Weed Sewing Machine.*—Weed Sewing Machine Company, No. 613 Broadway, New York.

Is decidedly the best family sewing machine in the exhibition. Its merits are: 1st. Simplicity in construction, elegance of model and finish and thorough workmanship. 2d. An ingenious and noiseless arrangement for adjusting the tension during the passage of the shuttle. 3d. A first class noiseless feed and device for regulating the same to any length of stitch. 4th. Being constructed under a thorough system, in case of accident, any of its parts can be easily duplicated. 5th. Made of best material.

We would, therefore, award them first medal and diploma. We would further add, that this machine, in our opinion, is better than any of its kind known to us.

No. 545. *Tucker and Plaiter for Sewing Machines.*—Morehouse & Heath, Hartford, Connecticut.

Its merits are: 1st. Simplicity. 2d. Ease of attachment to any machine. It prepares the pleat automatically. We award it first medal and diploma. We would further add that, in our opinion, it is better than any article of its kind known to us.

No. 1,090. *Warth Sewing Machine.*—Alben Warth, Stapleton, S. I.

Is a very meritorious and ingenious machine, and for manufacturing purposes we consider it decidedly the best machine on exhibition. Its merits are: 1st. Rotating shuttle, which admits of higher speed than a reciprocating shuttle. 2d. The shuttle admits of a much longer bobbin. 3d. With such shuttle the motion of the needle is much shorter. 4th. The needle is little over half the length of the ordinary needle, enabling it to be run at a higher speed, increased power. 5th. The needle leaves the fabric before the thread is drawn to tighten the stitch, saving much stress upon the thread. 6th. The attachment accompanying the machine enables it to do a great variety of fancy sewing. We therefore award it first medal and diploma. We would further add, that in our opinion, it is better than any

machine of its class known to us, and consider that it has the elements of a very superior machine.

No. 726. *The Hinkley Knitting Machine.*—The Hinkley Knitting Machine Company, 176 Broadway, New York.

This is the only machine of this kind on exhibition. We consider it a very simple and ingenious machine for the work it is intended to do. Not liable to get out of order. It does a good variety of work. We award it first medal and diploma. We would further add, that in our opinion, this is better than any other machine of its class known to us.

No. 761. *Eyeletting Machine.*—Albert Komp, 215 Centre street, New York.

Is a good, simple, self-feeding machine for fastening eyelets. It does its work well, is not liable to get out of order. We award it second medal and diploma.

No. 616. *Noiseless Feed for Sewing Machine.*—Benedict Manufacturing Company, 636 Broadway, New York.

We consider it to be an improvement upon the feed it is intended to supersede. We award it a diploma.

No. 686. *Empire Sewing Machine.*—Empire Sewing Machine Company, 294 Bowery, New York.

We consider this a very desirable machine, well adapted to sewing leather and heavy fabrics. We award it second medal and diploma.

No. 388. *Wagener Sewing Machine.*—Wagener Manufacturing Company, 825 Broadway, New York.

This machine is a decided improvement upon machines making this class of stitch. It chiefest merit is, that by elevating one end of it, an endless circular seam can be made, making it a very desirable machine for sewing sleeves, &c. We consider it a good family machine. We award it second medal and diploma.

No. 117. *Tuck Creaser for Sewing Machines.*—Isaac W. Barnum, 636 Broadway, New York.

Is well adapted for the work it is intended to do. It is simple and can be attached readily to any sewing machine. We award it second medal and diploma.

No. 390. *Stackpole's Broom Sewing Machine.*—Greenleaf Stackpole, 21 Cortlandt street, New York.

Is an ingenious machine for sewing brooms. Its merits are simplicity, durability, not liable to get out of order. It can be easily adapted to other purposes, as the stitching of pamphlets, magazines,

&c. We award it first medal and diploma. We know of no other machine of its kind.

No. 685. *Sewing Machine Castors.*—B. F. Ryder, 301 West Thirty-ninth street, New York.

They are well adapted to the purpose for which they are intended. We award them diploma.

THOS. J. SLOAN,
HENRY W. STEELE,
Judges.

New York, *October* 28*th*, 1869.

REPORT ON ARTIFICAL TEETH.

To the Board of Managers:

GENTLEMEN.—The undersigned, judges in department three, group five, division one, report that they have carefully and impartially examined the several competing articles submitted to them. The best article of those intended to accomplish the same object is mentioned first, and the remaining articles of the same class in their relative order of merit.

While we have deemed it unnecessary to point out what seemed to us defects in any article, we have, on the other hand, stated in brief terms the commendable qualities in those which have received our highest approval, which are not only the best on exhibition, but equal or better than any elsewhere known to us.

No. 326. *Case of Artificial Teeth.*—S. S. White, 767 and 769 Broadway, New York.

As these are the only articles that come in competition in this group we shall report on them together. The teeth exhibited by S. S. White do not present any marked superiority in color, shape, size, or relative position when in sections.

As tested under pressure, and repeated blows, they are somewhat stronger than H. D. Justi & Co's.

Their capability of resisting the heat of the blow-pipe is no greater than those of Justi's. In regard to the shape and insertion of the pin in the body of the teeth now manufactured by S. S. White, the improvement is manifestly great over any other manufacturer known to us.

This improvement consists of the shape of that part of the pin that is inserted in the tooth, and which he styles the "foot shaped" pin. In making this pin the wire is "upset," so that the thickest part of the pin is at the heel or angle, the point or toe running upward into the thick part of the tooth giving additional security against its being drawn out.

There is also, in the opinion of the judges, a decided gain in the

direction or angle in which the pin is inserted in the tooth, as by this mode of insertion the thin portion of the tooth is not weakened as is done when the headed pin is inserted in a straight line, but gives the greatest amount of resistance where the greatest strain is brought to bear upon the surfaces; in biting and masticating, the force exerted being outward and downward toward the neck of the tooth, which the shape and direction of the pin is thus made directly to oppose. (The judges have illustrated their report by diagrams which cannot be here inserted.) We consider this so great an improvement in the manufacture of teeth, that we recommend it for special consideration, and high award.

We have also carefully examined the dental instruments exhibited by S. S. White, and find them of superior finish and excellent temper. We would particularly mention the perfection with which the burrs and serrations, on the points of the filling instruments, are cut; the shapes of the various kinds of filling instruments are admirable.

In accordance with the wish expressed by the Board of Managers, we were very particular in testing the temper of these instruments to ascertain if this important point had been attended to with the same care and skill as was evident in the other parts of their construction, and we found that in this particular their manufacture had been as carefully conducted as in the other parts, and that the instruments had the varieties of temper best suited to the purposes for which they were constructed. And we pronounce them to be the best we have ever seen produced by any manufacturer of dental instruments, and recommend that such evidence of excellence should be rewarded by a high award.

No. 53. *Artificial Dentures.*—J. Allen & Son, 22 Bond street, New York.

The peculiarities of this method of mounting teeth is great strength, durability and cleanliness, and great adaptability to the varieties of cases.

The mechanical execution of the pieces on exhibition is excellent, but there is nothing new in those presented at this fair.

JOHN B. RICH,
S. A. MAIN,
E. C. RUSHMORE,
Judges.

REPORT OF JUDGES ON ARTIFICIAL LIMBS.

To the Board of Managers:

Gentlemen.—The undersigned, judges in department three, group five, division two, report that they have carefully and impartially examined the several competing articles submitted to them. The best article of those intended to accomplish the same object is mentioned first, and the remaining articles of the same class in their relative order of merit.

While we have deemed it unnecessary to point out what seemed to us defects in any article, we have, on the other hand, stated in brief terms the commendable qualities in those which have received our highest approval, which are not only the best on exhibition, but equal or better than any elsewhere known to us.

No. 44. *Artificial Limbs.*– A. A. Marks, 575 Broadway, New York.

Best. This limb is constructed with an India-rubber foot, which, from its elasticity, does away with the necessity of motion at the ankle-joint, and also obviates entirely that heavy thumping sound when the foot strikes the ground in walking; an objection which exists in all other artificial legs which the committee have any knowledge of. The control which the wearer has over it, and its movements so closely resembling those of the natural limb, as well as the small cost of keeping it in repair (almost nothing), entitle it to the highest commendation.

No. 37. *Artificial Limbs.*—Monroe & Gardiner, 413 Canal street, New York.

Although the committee place this limb second in order of merit, they would state that its claims are very close with those of its competitor, and they take pleasure in bearing testimony to its excellence. Among the noticeable features which presents, is the mode by which it is fastened to the stump, whereby the soft tissues are partly drawn down below the end of the bone, which renders the sides of the stump more firm, and reduces the amount of motion between it and the

socket of the limb, and consequently of friction, thereby obviating the greater part, if not all, of the liability to irritation of the stump. The material of which it is composed, viz., raw hide, prepared in such a way as to resist the action of heat and moisture to which it may be liable, and perforated, allowing a circulation of air within, as well as being light and durable, is, in the opinion of the committee, of advantage. The limb merits high commendation.

No. 221. *Surgical Operating Table and Oculist's Operating Chair.* —Thomas McIlroy, 145 Perry street, New York.

Are of ingenious contrivance, aud so admirably answer the purposes for which they are designed, as to be worthy of special commendation. The other articles in this collection, viz., fracture bedstead, invalid bedstead and fracture extension appliance, are of much practical utility, and worthy of favorable notice.

LEWIS A. SAYRE, M. D.,
JAMES R. MAC GREGOR, M. D.,
Judges.

New York, *October 28th*, 1870.

REPORT ON AGRICULTURAL IMPLEMENTS.

To the Board of Managers:

GENTLEMEN.—The undersigned, judges in department seven, group four, report that they have carefully and impartially examined the several competing articles submitted to them. The best article of those intended to accomplish the same object is mentioned first, and the remaining articles of the same class in their relative order of merit.

While we have deemed it unnecessary to point out what seemed to us defects in any article, we have, on the other hand, stated in brief terms the commendable qualities in those which have received our highest approval, which are not only the best on exhibition, but equal or better than any elsewhere known to us.

No. 25. *Single Horse Cultivator.*—Fords & Howe, Oneonta, New York.

Is one of a cheaper kind than the two horse, more suitable for those not having as much to till, it does the same character of work however, cultivates but one row at a time, but is a complete success. We think it suitable for any kind of soil except it be very rocky; it is supported by a pair of shafts which extend far enough in the rear to serve as handles, by which it may be raised over a stone or any obstacle in its path; it can be moved from place to place, by means of a wheel, as easily as any wheelbarrow. In the judgment of the committee, it is also worthy of the first premium.

No. 25. *Two-horse Cultivator.*—Fords & Howe, Oneonta, New York.

Is a two-horse cultivator which we think is splendidly adapted for the cultivation of crops throughout the great west and south; in fact, it is just the thing for farmers in any section whose farms are free from stone. The tongue is slotted, and of sufficient width to prevent the horses from crowding together and trampling down the crop in the middle row; it works upon a pivot which easily enables

the driver, by means of a slight pressure of the foot, to deviate from a straight line, thereby permitting him to work crooked rows.

The wheels and shovels are adjusted so that rows of any width may be worked ; shovels may either be added or removed, making it pulverize the entire surface over which it passes, or a number of distinct rows if required.

There is but little strain upon the frame work, the draft being in a direct line from the ends of pendants, to which the shovels are attached ; it will cultivate to any depth thought desirable, to the extent of six inches.

Aware of many impositions practiced upon the agricultural community by the introduction of worthless machinery, we realize the necessity of exercising the greatest care in encouraging the purchase of new and untried implements; still, we feel it a duty, incumbent upon us, to commend those articles that have been well tested and whose practical utility must be obvious to even those of the most limited experience. We take pleasure in recommending the two-horse cultivator No. 25, and think that it certainly merits the first or highest premium.

No. 1,321. *Weeding Hoe and Propelling Weeder.*—S. Springstead, Unionport, New York.

We think both are articles of merit. The hoe is something the shape of a common hoe, with sections cut out the sides and edges sharpened ; this obviates the necessity of hacking with the corner of the hoe to obtain dirt in hoeing crops, as farmers have been generally compelled to do ; the prongs penetrate the earth more readily; it also cuts the weeds more effectively ; it is spoken of very highly by those that have used it.

The propelling weeder is a decided improvement on the old scuffle hoe, it consists of a broad piece of steel drawn out to a point with numerous notches on its sides, which are ground down sharp, both implements are good, we think them worthy of the first premium.

No. 151. *Cast Steel Plows.*—Collin's Plow Company, 212 Water street, New York.

Were of fine finish, steel, well modeled to accomplish good results, and we consider them worthy of commendation and first premium.

It requires but little experience with any practical farmer to prove the superiority of the steel over the iron plows, in any kind of soil, not even excepting where rocks are in abundance.

No. 151. *Rotary Harrow.*—New York Harrow Association, 35 and 37 Park Place, New York.

Is a rotary harrow, pulverizer and grain coverer; we think this harrow worthy of the first premium; having had considerable experience in its use, we feel fully satisfied in saying that it meets the want of the farmer better than any other brought to our notice, its rotating motion keeps it from clogging, covers the grain admirably, levels the ground and pulverizes the soil to perfection, it will clear itself from any stone or stump upon which the teeth may happen to catch; in our estimation, once harrowing with this harrow, is as effective as twice harrowing with any other we have seen in operation; we can conscientiously recommend it for general use among farmers, it is adapted to all kinds of ground, it is cheap, substantial and answers every purpose. Too much cannot be said in its favor.

No. 736. *Cylinder Plow.*—R. H. Allen & Co., 191 Water street, New York.

Two plows on same beam, almost indentical with the double Michigan plow, used for turning sod and subsoiling at the same time. An excellent plow of the kind, worthy of a diploma.

No. 416. *Williamson's Whiffle-trees for Double Teams.*—Benjamin Haskell, 190 Duane street, New York.

Whiffle-trees for double teams and heavy work, consist of a heavy bar, sprung and steam bent; at the center is hung a friction roller or pulley through which a chain passes; to the ends of this chain the inside traces are connected; in this manner the draft is equalized. Its advantages are simplicity, durability, its equalization of draft, and great strength. In our estimation it deserves the first premium.

DEPARTMENT VII.—GROUP 5.

No. 651. *Mowing Machine* (*Buckeye*).—Adriance, Platt & Co., 165 Greenwich street, New York.

This machine has in all probability given more universal satisfaction than any other with which we have had any experience, although the vast improvement made in the construction of other mowers is rapidly bringing them into favor. Even now they threaten to become successful competitors. It is next to impossible for us, as a committee, to pass judgment upon the relative merits of machines not in operation that possess so many good points, by a simple examination. The only true means of deciding is to give them an opportunity of demonstrating their special claims of superiority under

equally favorable circumstances in the field, and the committee respectfully suggest the propriety of awarding no premiums hereafter until such claims shall have been proven. We are well aware that there has already been a number of such contests; but the application of new inventions renders it but just that another should take place the ensuing year, for it would be unreasonable to suppose that with the great progress made of late in mechanics as a science that there could be no further improvement in this equally as good. We do not wish by so saying to deprive those machines, which have been held so high in the estimation of the public, of the credit they deserve. Neither do we wish to discourage the praiseworthy efforts of those endeavoring to construct an implement which may prove its superiority by commending an inferior article.

We are satisfied that there are mowers of lighter draft and more rapid vibration of the cutting bar that will accomplish results equally as good. Among them are the Columbian and the Clipper. Yet we have no positive knowledge that these three machines, with their late improvements, have ever come in direct competition. In this case, as in some others, we feel the necessity of being governed, to a certain extent, by facts already accomplished.

In the principal field trials that have taken place in this country, the Buckeye has not only given good satisfaction, but has in almost every instance been victorious. Consequently in this instance a strict sense of duty imperatively demands that we award the first premium to the Buckeye machine as a mower. A description of this machine has been so often given that we deem it unnecessary to occupy further your time and attention with a detail of its construction. Suffice it to say that it is substantial and looks well.

No. 655. *Columbian Mowing Machine.*—American Agricultural Works, corner Twenty-fourth street and Tenth avenue, New York.

To this machine we award the second premium, we regard it as the most dangerous competitor of the Buckeye; it is of quicker motion, and with each movement of the cutting bar, each knife is driven through the finger, making it impossible to clog; the draft is also lighter; it is a capital machine, and worthy of high commendation.

No. 652. *Mower and Reaper combined, with Self-Rake.*—Adriance, Platt & Co., Poughkeepsie, N. Y.

This machine has been throughly tested, and merits with general approval. To this (the Buckeye) we award the first premium.

No. 655. *The Columbian Combined Mower and Reaper, with Self-Rake.*—American Agricultural Works, corner Twenty-fourth street and Tenth avenue, New York.

This machine promises well; we see no reason why it should not rate A, 1; hardly a choice between this and the Buckeye; worthy of second premium.

No. 30. *The American Hay Tedder.*—Ames Plow Company, 53 Beekman street, New York.

For tedding hay; every practical farmer can appreciate the importance of this machine; there are but few so blind as to be unwilling to concede the superiority of hay cut and properly cured early in the season; upon their ability to accomplish this, not only depends the condition of their live stock, but to a certain extent their financial success. In many sections of country it has proved impracticable to pursue the old system of cultivation by rotation of crops, and in such cases it has been found expedient for farmers to turn their attention, more and more, to the production of the hay crop, the successful harvesting, of which has become of the most vital importance through the northern and eastern States. Next to the mowing machine the tedder is the most useful implement of the farm, it will do the labor of ten or twelve men at least, and will cure the hay in half the time. The American tedder has the advantage of being nearer to the ground, and its work, than any other, consequently is not affected so much by the wind; its motion is less violent and more uniform, the nuts and bolts are not as easily lost, thereby causing delay and loss in the most busy season, and it works to perfection on uneven as well as on even ground. It is worthy of the first premium.

No. 96. *Corn Husker and Sheller and Model of Corn Bin.*—D. A. Dickinson, 125 Fulton street, New York.

Owing to the high price and worthlessness of common field labor, as well as to extensive cultivation, it has been found expedient by the producer to resort, in every instance possible, to the use of labor-saving machinery. By the great corn growers of the west there has long been felt the urgent want of a machine to separate the husk from the grain, as well as a power corn sheller. The inventive genius of the country has at last supplied us with the long-desired article. In No. 96 we have both combined. It is claimed for this machine that it will save five cents per bushel on husking and shelling, an important item in a field of two or three thousand bushels. We can see no reason why it should not do all that is claimed for it,

and think it worthy of the highest commendation. We think it is worthy of a first premium.

The model of corn bin is certainly novel and ingenious, and withal very simple. It consists of a box, house or bin, with two pieces of plain board nailed together at right angles. This is then bored through in the angle formed by these boards, making a complete air chamber. These are placed at intervals throughout the bin. It is claimed that corn will dry thoroughly if sufficient water be thrown in to saturate it. We recommend to it the first premium.

No. 77. *Power Cider Press, Hand Cider Press.*—Daniels' Machine Company, Woodstock, Vt.

Both compact and substantial. The principle of this cider mill is that it crushes with a rolling pressure, and the surface of one roller running faster than the other, and both being armed with ribs, one scrapes the other, which keeps both clear. It was formerly thought that the most cider could be obtained by grating the apples, but experience proves this not to be the case. More price is obtained for cider made from fruit that has been mashed fine in a rolling cider mill. For this we recommend the first premium.

Department VII.—Group 6.

No. 1. *Wall Builder and Stump Extractor.*—G. W. Packer & Co., Mystic River, Conn.

A very useful machine, particularly in a stony country. Stone could be moved much more easily with this machine than as farmers often move them, on stone boats, and without injury to their teams. It is estimated by those who have used them that they save from one-quarter to one-third in building wall. The committee witnessed the extraction of a stone of at least ten tons in weight that was hardly visible, being covered with earth, and that without removing a shovelful of earth from around it. It was raised by four men in less than ten minutes. It is free from objection often raised to the two wheeled machines, that of bearing so heavily upon the necks of the oxen that work it. It is impossible for oxen to endure the pressure and constant jarring of a two wheeled machine when loaded heavily. Such power applied to such leverage is almost beyond the conception of a careless observer. This machine being upon four wheels, this difficulty is fully obviated. Another advantage is, a foundation stone can be drawn immediately in line with any fence that is being built.

We feel fully justified in recommending it, and award to it a first premium.

FRANK D. CURTIS,
JOSIAH H. MACY,
SIMEON LELAND,
Judges.

New York, *October 28th*, 1869.

It is quite impracticable to print in the present volume all the reports of the judges at the last exhibition. The extracts thus far given are fair samples of the whole, and show the ability and discernment of the gentlemen who devoted much time and care to the examination of the several articles respectively submitted to them, and whose names will be found immediately preceding the list of awards made in accordance with their decisions.

WOOL MANUFACTURES.

Exhibited under the Direction of the National Association of Wool Manufacturers, at the Thirty-eighth Annual Exhibition of the American Institute of the City of New York, 1869.

The National Association of Wool Manufacturers having decided to make an exposition of the products of their special industry, were generously invited by the American Institute to exhibit under their auspices, at the Thirty-eighth Annual Fair of the Institute, to be held in the city of New York in the fall of 1869.

The object of the exposition was to make known the extent, variety, and actual condition of the wool industry of the United States, rather than to adjudge the comparative merits of competing manufacturers; exhibitors, therefore, were requested to exhibit mainly such articles as they are accustomed to make for the general market. Exhibitors were informed that an official catalogue would be published, in which the name or business card of every exhibitor and a designation of his contributions would appear. The present catalogue is made in conformity with this promise.

The executive committee of the National Association of Wool Manufacturers have the satisfaction to believe that the display of the goods herein designated is such as will serve to make known to the American people their dependence upon their own productions, and will tend to create that public sentiment in favor of the products of our own soil and labor which is indispensable to the proper success of our manufactures, and at the same time will, by emulation and example, elevate the standard of the American wool industry and its dependencies.

ERASTUS B. BIGELOW, *President.*
J. WILEY EDMANDS,
THEODORE POMEROY,
N. KINGSBURY,
GEORGE ROBERTS,
E. R. MUDGE,
R. C. TAFT,
J. H. BURLEIGH,
J. W. STITT,
GEORGE S. BOWEN,
GEORGE BULLOCK,
Executive Com. of the Nat. Association of Wool Manuf.

JOHN L. HAYES, *Secretary.*
N. KINGSBURY,
Superintendent of the Exposition.

CATALOGUE OF ARTICLES ON EXHIBITION.

No. 1.—Pacific Mills, Lawrence, Mass. *Treasurer*—J. Wiley Edmands, No. 31 Kilby street, Boston, Mass. *Selling Agents*—James L. Little & Co., Nos. 59 Leonard street, New York, and 22 Franklin street, Boston. 45 pieces printed delaines; 24 pieces printed armures; 9 pieces printed serge; 12 pieces printed alpacas; 17 pieces printed imperial reps; 11 pieces three-fourths assorted colors armures; 6 pieces three-fourths glace colors armures; 10 pieces three-fourths glace colors serges; 4 pieces three-fourths assorted colors serges; 12 pieces three-fourths assorted colors alpacas; 5 pieces three-fourths assorted colors reps; 23 pieces six-fourths assorted colors merinos; 10 pieces six-fourths assorted colors poplin alpacas; 5 pieces six-fourths assorted colored Roubaix cloth; 20 pieces four-fourths all worsted elastic serge.

No. 2.—Gold Medal Braid Company, Attleboro, Mass. *Treasurer*—H. N. Daggett, Attleboro. *Selling Agents*—George S. Moulton & Co., 101 Chambers street, New York. 150 pieces worsted braids, in all varieties of colors.

No. 3.—Lippit Woolen Company, Woonsocket, R. I. *Treasurer*—Charles H. Merriman, Providence, R. I. *Selling Agents*—Denny, Poor & Co., Nos. 21 and 23 White street, New York. 40 pieces six-fourths fancy cassimeres, Shepherds and Scotch plaids; 46 pieces six-fourths fancy cassimeres, diagonals, stripes and checks; 12 pieces six-fourths fancy cassimeres, ribs; 10 pieces six-fourths fancy cassimeres, hair lines; 15 pieces six-fourths silk mixed cassimeres; 20 pieces six-fourths black, blue, olive, and brown coatings; 3 pieces six-fourths black beavers.

Nos. 4 and 5.—Washington Mills, Lawrence, Mass. *Treasurer*—Henry F. Coe, No. 15 Chauncey street, Boston, Mass. *Selling Agents*—E. R. Mudge, Sawyer & Co., Nos. 43 and 45 White street, New York, and 15 Chauncey street, Boston. 12 pieces three-fourths Nevada plaid; 19 pieces three-fourths Paris Exposition opera flannels; 1 piece 50-inch blue carriage cloth; 1 piece six-fourths black castor; 1 piece six-fourths cassimere; 1 piece six-fourths blue Moscow beaver; 1 piece six-fourths mixed Moscow beaver; 1 piece six-fourths black Moscow beaver; 1 piece six-fourths blue Moscow beaver wool dyed; 1 piece six-fourths olive mixed Moscow beaver, wool dyed; 1 piece six-fourths brown A. W. Tricot; 1 piece six-fourths blue A. W. Tricot; 1 piece six-fourths olive A. W. Tricot, broadcloth; 2 pieces six-fourths blue A. W. Tricot broadcloth; 1 piece six-fourths dahlia A. W. Tricot broadcloth; 1 piece six-fourths black A. W. Tricot broadcloth; 1 piece six-fourths black double milled doeskin; 1 piece six-fourths dahlia double milled doeskin; 2 pieces six-fourths blue double milled doeskin; 7 72 by 72 super shawls; 18 72 by 72 Lady Washington shawls; 5 72 by 144 Lady Washington shawls; 13 72 by 144 Lady Washington shawls, stripes; 25 72 by 72 Lady Washington shawls, stripes; 18 pieces six-fourths Waverly cloakings; 3 pieces six-fourths fall Scotch cassimeres; 23 pieces six-fourths Scotch cassimeres; 5 pieces six-fourths diagonal cloakings; 1 50-inch coupe cloth (wool dyed); 4 pieces three-fourths super opera flannels; 2 pieces three-fourths Italian cloths, cotton warp and worsted filling; 38 pieces 28-inch American worsted plaid poplins; 9 pieces six-fourths sackings; 2 pieces 27-inch Martelle cloth; 4 52 by 52 felt covers; 8 56 by 56 felt covers; 2 66 by 66 felt covers; 4 56 by 108 felt covers; 1 piece six-fourths blue Bengal coating; 1 piece six-fourth blue extra Washington coating; 1 piece 52-inch pelisse cloth; 6 pieces six-fourths Caledonian cloakings; 2 pieces Empress cloths, worsted; 2 gold medal striped shawls, worsted; 1 Lady Washington striped shawl.

No. 6.—Hamilton Woolen Company, Southbridge, Mass. *Treasurer*—J. Ballard, Jr., No, 31 State street, Boston, Mass. *Selling Agents*—Gardner, Brewer & Co., Nos. 62 Leonard street. New York, 57 Federal street, Boston, and 246 Chestnut street, Philadelphia. 19 pieces Tycoon reps; 62 pieces fancy delaines.

No. 7.—Saltsbury Mills, Amesbury, Mass. *Treasurer*—John Gardner, No. 31 State street, Boston, Mass. *Selling Agents*—Gardner, Brewer & Co., Nos. 62 Leonard street, New York, 57 Federal street, Boston, and 246 Chestnut street, Philadephia. 2 pieces six-fourths repellants; 3 pieces three-fourths plaid opera cloths; 2 pieces six-fourths ladies cloths; 2 pieces six-fourths plaid cloakings; 4 pieces six-fourths fur beavers; 7 pieces six-fourths Chinchilla beavers; 5 fancy Maud shawls; 1 piece coating.

No. 8.—Essex Works, Franklin, N. J. *Proprietors*—William Duncan & Sons, Franklin. *Selling Agents*—L. W. & H. B. Duncan, Franklin. 10 pieces Duncan's A printed operas; 5 pieces printed cashmeres; 4 pieces printed robe flannels; 4 sample cards printed flannels; 5 six-fourths fancy printed covers; 3 six-fourths printed covers; 5 eight-fourths embossed operas; 2 six by eleven embossed operas; 3 eight-fourths fancy printed covers; 3 eight by twelve fancy printed covers; 3 four-fourths embossed covers; 6 eight by twelve embroidered covers (in cases); 1 twelve-fourths pair Whitney blankets; 4 eleven-fourths embroidered blankets; 4 embroidered crib blankets; 3 sample cards Duncan's embroideries; 3 pieces Duncan's furniture cloths; 2 pieces baizes; 3 sample cards furniture cloths.

Thirty years ago, when the senior member of this firm commenced business, none of the goods mentioned above were manufactured in this country. Twenty-seven years ago they placed on exhibition at the fair of the American Institute, the first table-cloth ever printed in this country, receiving a diploma therefor.

No. 9.—Riverside Mills, Providence, R. I. *Proprietors*—Chapin & Downes, Providence. *Selling Agents*—Hoyt, Spragues & Co., Nos. 107, 109, 111 and 113 Franklin street, New York. 3 pieces black astrachan; 4 pieces purple astrachan; 1 piece blue astrachan; 1 piece orange astrachan; 16 pieces chinchillas, in red, white, blue, mixed, and various shades of drabs; 10 carriage robes, in plain and fancy plaid colors.

No. 10.—Byram River Mills, Port Chester, N. Y. *Agent*—S. H. Le Fevre, Port Chester. *Selling Agents*—Hoyt, Spragues & Co., Nos. 107, 109, 111 and 113 Franklin street, New York. 13 pieces C. W. chinchillas, in different shades of browns and drabs.

No. 11.—Nonipsic Mills, Warehouse Point, Ct. *Selling Agents*—Sprague, Colburn & Co., Nos. 55 and 57 White street, New York. 3 pieces three-fourths fancy doeskins.

No. 12.—American Mills, Rockville, Ct. *Agent*—J. J. Robinson, Rockville. *Selling Agent*—Sprague, Colburn & Co., Nos. 55 and 57 White street, New York. 5 pieces six-fourths meltons; 6 pieces six-fourths plaid cassimeres; 4 pieces three-fourths fancy cassimeres.

No. 13.—Elliott Felting Mills, Franklin City, Mass. *Selling Agents*—Sprague, Colburn & Co., Nos. 55 and 57 White street, New York. 18 embossed table and stand covers, of different styles.

No. 14.—Atlantic Delaine Company, Providence, R. I. *Treasurer*—George W. Chapin, Providence. *Selling Agents*—Hoyt, Spragues & Co., Nos. 107, 109, 111 and 113 Franklin street, New York. Three-fourths figured orientals; three-fourths corded reps; three-fourths mohair lustres; three-fourths mohair lustres changeable

three-fourths alpaca lustre; 32-inch fine coburgs; 36-inch merino coburgs; three-fourths colored mohair plaids; three-fourths black and white plaids; 32-inch black Italians; 27-inch black Italians; 32-inch black imitation Italians; 27-inch black imitation Italians; 32-inch colored Italians; 27-inch colored Italians; 27-inch colored imitation Italians.

No. 15.—Keystone Mills, New Brighton, Pa. *Proprietors*—Wilde, Shield & Co., New Brighton. *Selling Agents*—Hoyt, Spragues & Co., Nos. 107, 109, 111 and 113 Franklin street, New York. 4 W 72 by 144 high colored fine long shawls; 3 AA 72 by 144 high colored and gray mixed superior shawls; 2 A 72 by 144 high colored long shawls; 2 B 72 by 144 high colored and gray mixed plaid shawls.

No. 16.—Jesse Eddy & Son, Fall River, Mass. *Selling Agents*—Spaulding, Hunt & Co., Nos. 40 and 42 Leonard street, New York. 13 pieces six-fourths fancy cassimeres, side stripes; 9 pieces six-fourths fancy cassimeres, plaids; 1 piece six-fourths fancy cassimeres, blue diagonal; 1 piece six-fourths fancy cassimeres, black and white check.

No. 17.—Star Mills, Middleboro, Mass. *Treasurer*—George Brayton, Middleboro. *Selling Agents*—Thomas & Co., Nos. 9 and 11 White street, New York. 1 piece six-fourths brown mixed fancy plaid; 1 piece six-fourths drab mixed fancy plaid; 1 piece six-fourths brown fancy stripes; 1 piece six-fourths mixed fancy stripes; 1 piece nine-fourths drab fancy stripes.

No. 18.—Rock Manufacturing Company, Rockville, Ct. *Treasurer*—S. D. W. Harris, Rockville. *Selling Agents*—Thomas & Co., Nos. 9 and 11 White street, New York. 1 piece six-fourths drab plaid fancy, side stripes; 1 piece six-fourths cadet mixed fancy, side stripes; 1 piece six-fourths light brown fancy, side stripes; 1 piece six-fourths dark brown fancy, side stripes; 1 piece six-fourths cadet ribbed fancy, side stripes; 1 piece six-fourths light brown ribbed fancy, side stripes; 2 pieces six-fourths dark brown ribbed fancy, side stripes.

No. 19.—New England Company, Rockville, Ct. *Agent*—A. Park Hammond, Rockville. *Selling Agents*—Thomas & Co., Nos. 9 and 11 White street, New York. 1 piece six-fourths blue and purple fancy plaid; 1 piece six-fourths blue and drab fancy plaid; 1 piece six-fourths black and white fancy plaid; 1 piece six-fourths green and white fancy plaid; 1 piece six-fourth brown and white fancy plaid; 1 piece six-fourths black and white mixed fancy plaid; 1 piece six-fourths brown mixed fancy plaid; 1 piece six-fourths green mixed fancy plaid, side stripes; 2 pieces six-fourths ribbed drab fancies, side stripes.

No. 20.—Rock Manufacturing Company, Rockville, Ct. *Treasurer*—S. D. W. Harris, Rockville. *Selling Agents*—Pomeroy, Adams & Co., Nos. 70 and 72 Leonard street, New York. 11 pieces six-fourths mixed fancies, ribbed, side stripes; 6 pieces six-fourths drab, mixed fancies, side stripes; 4 pieces six-fourths broken plaid fancies, side stripes; 2 pieces six-fourths diagonal fancies, side stripes; 4 pieces six-fourths light cadet fancy plaids, side stripes; 4 pieces six-fourths dark cadet fancy plaids, side stripes; 2 pieces six-fourths dark brown fancy plaids, side stripes; 2 pieces six-fourths Scotch plaids; 3 pieces six-fourths fancy plaids.

No. 21.—Hockanum Company, Rockville, Ct. *Agent*—George Maxwell, Rockville. *Selling Agents*—Pomeroy, Adams & Co., Nos. 70 and 72 Leonard street, New York. 12 pieces six-fourths spring styles mixed fancies, side stripes; 2 pieces six-fourths olive mixed fancies, side stripes; 1 piece six-fourths brown mixed fancies, side stripes; 1 piece six-fourths brown mixed fancies, brown and white, side stripes; 1 piece six-fourths cadet mixed fancies, black and white, side stripes; 3 pieces six-

fourths ribbed fancies, side stripes; 3 pieces six-fourths mixed light cadet fancy plaids, side stripes; 24 pieces six-fourths fancy plaids in all varieties of colors, with side stripes.

No. 22.—NORTH ADAMS WOOLEN COMPANY, NORTH ADAMS, MASS. *Selling Agents*—Pomeroy, Adams & Co., Nos. 70 and 72 Leonard street, New York. 1 piece six-fourths mixed fancy cassimeres, side stripes.

No. 23.—UTICA STEAM WOOLEN MILLS, UTICA, N. Y. *Proprietors and Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers street, New York. 10 pieces six-fourths fancy cassimeres; 4 pieces six-fourths coatings.

No. 24.—KERNAN & HELM, UTICA, N. Y. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers street, New York. 12 pieces six-fourths fancy cassimeres; 2 pieces six-fourths beavers.

No. 25.—NIAGARA WOOLEN COMPANY, LOCKPORT, N. Y. *Agent*—John L. Davidson, Lockport, N. Y. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers streets, New York. 10 pieces three-fourths fancy cassimeres.

No. 26.—PONTOOSUC WOOLEN MANUFACTURING COMPANY, PITTSFIELD, MASS. *Agent*—T. Clapp, Pittsfield, Mass. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers streets, New York. 4 pieces six-fourths Pontoosuc repellants.

No. 27.—WASHINEE MANUFACTURING COMPANY, SALISBURY, CT. *President*—George Coffin, Salisbury. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers streets, New York. 1 piece six-fourths repellants.

No. 28.—LAWRENCEBURG WOOLEN MILLS, LAWRENCEBURG, IND. *Treasurer*—E. D. Moore, Lawrenceburg. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers streets, New York. 10 pieces six-fourths fancy cassimeres; 13 pieces three-fourths fancy cassimeres; 4 pieces six-fourths meltons.

No. 29.—HAWKINS, WEST & CO., DALTON, MASS. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade and Chambers streets, New York. 2 pieces six-fourths Windsor Falls repellants.

No. 30.—ARLINGTON MILLS, LAWRENCE, MASS. *Treasurer*—Wm. Whitman, No. 184 Devonshire street, Boston, Mass. *Selling Agents*—R. M. Bailey & Co., No. 184 Devonshire street, Boston. 12 pieces Roubaix poplins; 11 pieces Dublin twills; 9 pieces Arcadian plaids, in different styles and colors.

No. 31.—PHILADELPHIA DIAMOND WORSTED MILLS, PHILADELPHIA, PA. *Proprietors*—Scheppers Brothers, Philadelphia. *Selling Agents*—Oscar Delisle & Co., No. 52 Walker street, New York. 6 different qualities six-fourths black mohair lustres; 5 different qualities six-fourths colored mohair lustres; 12 pieces six-fourths French mohair poplins, all in different shades; 5 pieces six-fourths mohair poplins, all in different shades; 1 piece six-fourths mohair poplins, black.

No. 32.—HARRIS WOOLEN MILLS, WOONSOCKET, R. I. *Proprietors*—Taft, Weeden & Co., Providence, R. I. *Selling Agents*—J. C. Howe & Co., Nos. 67 and 69 Worth street, New York; 33 pieces six-fourths fancy cassimeres, in different styles of plaids, checks, stripes, and mixtures.

No. 33.—WEYBOSSET MILLS, PROVIDENCE, R. I. *Proprietors*—Taft, Weeden, & Co., Providence. *Selling Agents*—J. C. Howe & Co., Nos. 67 and 69 Worth street, New York; 29 pieces six-fourths fancy cassimeres, in different styles of plaids, checks, stripes, and mixtures.

No. 34.—PEKIN MILLS, MANAYUNK, PA. *Proprietor*—S. J. Solms, Philadelphia, Pa. 6 pieces three-fourths hair line tweeds, in mixed shades of brown and olives; 3 pieces three-fourths brown and olive-colored mixed jeans.

No. 35.—Woodvale Woolen Mills, Johnstown, Pa. 4 pieces three-fourths twilled fancy cassimeres; 9 pieces three-fourths plaid linseys.

No. 36.—Fitchburgh Woolen Mills, Fitchburgh, Mass. *Proprietors and Selling Agents*—Rufus S. Frost & Co., 32 Franklin street, Boston, Mass. 1 piece six-fourth brown carriage cloth.

No. 37.—Lounsbury, Bissell & Co., Winnipauk, Ct. *Selling Agents*—Jenkins, Vail & Peabody, 46 Leonard street, New York. 4 pieces six-fourths brown and drab Petersham felts; 1 piece six-fourth brown tricot felt; 1 piece six-fourth drab tricot felt.

No. 38.—Wanskuck Company, Providence, R. I. *Treasurer*—H. J. Steere, Providence. *Selling Agents*—Bauendahl & Co., Nos. 3, 5 and 7 White street, and 109 and 111 West Broadway, New York. 1 piece blue and silver tinsel ladies' fancy cloakings; 1 piece brown and silver tinsel ladies' fancy cloakings; 1 piece black and white mixed ladies' fancy cloakings; 1 piece brown and white mixed ladies' fancy cloakings; 1 piece purple and white mixed ladies' fancy cloaking; 6 pieces six-fourths diagonal coatings, different shades; 4 pieces six-fourths meltons, different shades; 4 pieces six-fourths Argyle coatings, different shades; 4 pieces six-fourths edredons, different shades; 1 piece six-fourth black fur beaver; 1 piece six-fourth blue eskimo; 1 piece six-fourth black eskimo; 3 pieces six-fourths Chinchillas, different shades; 3 pieces six-fourths Moutone, different shades; 3 pieces six-fourths Elysian, different shades.

No. 39.—Merrimack Mills, Lowell, Mass. *Treasurer*—Walter Hastings, No. 82 Milk street, Boston. *Selling Agents*—Bauendahl & Co., Nos. 3, 5 and 7 White street, and 109 and 111 West Broadway, New York. 8 pieces six-fourths fancy cassimeres, plaids; 3 pieces six-fourths fancy cassimeres, stripes; 2 pieces six-fourths fancy cassimeres, checks; 2 pieces six-fourths fancy cassimeres, mixtures; 1 piece six-fourth fancy cassimeres, diagonal.

No. 40.—Pittsfield Woolen Company, Pittsfield, Mass. *Treasurer*—William F. Bacon, Pittsfield. *Selling Agents*—Bauendahl & Co., Nos. 3, 5 and 7 White street, and 109 and 111 West Broadway, New York. 6 pieces six-fourths edredons, different shades; 2 pieces six-fourths piques, different shades; 6 pieces six-fourths elastiques, different shades; 5 pieces six-fourths tricots, different shades; 6 pieces six-fourths castor beavers, different shades; 8 pieces six-fourths meltons, different shades; 2 pieces six-fourths tricot long, different shades; 1 piece six-fourths blue Moscow beaver; 1 piece six-fourths blue doeskin; 1 piece six-fourths black doeskin.

No. 41.—Barrows Woolen Company, Dedham, Mass. *Proprietor*—Thomas Barrows, Dedham. *Selling Agents*—Bauendahl & Co., Nos. 3, 5 and 7 White street, and 109 and 111 West Broadway, New York. 8 pieces three-fourths Scotch mixed cassimeres.

No. 42.—L. Pomeroy's Sons, Pittsfield, Mass. *Selling Agents*—Sullivan, Budd & Co., Nos. 80 and 82 White street, New York. 1 piece six-fourths gold mixed coating; 1 piece six-fourths purple coating; 1 piece six-fourths West Point cadet cloth; 1 piece six-fourths sky-blue kersey; 1 piece six-fourths olive castor; 1 piece six-fourths blue and gold mixed castor; 1 piece 60-inch blue melton; 1 piece six-fourths blue and gold mixed melton; 1 piece 60-inch olive melton; 1 piece 54-inch olive melton; 1 piece six-fourths Alaska union coating.

No. 43.—Norwalk Mills, Winnipauk, Ct. *Agent*—Charles C. Betts, Winnipauk. *Selling Agents*—Jenkins, Vail & Peabody, 46 Leonard street, New York. 15 pieces six-fourths fancy cassimeres.

No. 44.—WARSAW WOOLEN MILLS, WARSAW, ILL. 5 pieces three-fourths fancy cassimeres.

No. 45.—CONSHOHOCKEN WOOLEN MILLS, PHILADELPHIA, PA. *Proprietors and Selling Agents*—Benjamin Bullock's Sons, Nos. 37 Letitia street, Philadelphia, and 40 Walker street, New York. 3 pieces six-fourths black doeskin beaver; 1 piece six-fourths black doeskin satin; 2 pieces six-fourths black doe satin extra; 1 piece six-fourths brown doeskin double; 1 piece six-fourths blue doeskin double; 1 piece six-fourths blue coating elastique; 1 piece six-fourths olive coating elastique; 1 piece six-fourths black fine coating; 1 piece six-fourths black twilled coating; 1 piece six-fourths blue twilled coating; 2 pieces six-fourths coating elastique; 2 pieces six-fourths black satin (fine); 1 piece six-fourths dahlia draps.

No. 46.—ELBŒUF MILLS, LITTLE FALLS, N. Y. *Proprietors*—Stitt & Underhill, 152 Chambers street, New York. *Selling Agents*—Kendall, Opdyke & Co., Nos. 50 and 52 Franklin street, New York. 1 piece six-fourths blue and gold silk mixed cassimeres; 1 piece six-fourths dahlia and gold silk mixed cassimeres; 1 piece six-fourths black and gold silk mixed cassimeres; 1 piece six-fourths brown and gold silk mixed cassimeres; 1 piece six-fourths blue and white silk mixed cassimeres.

No. 47.—YANTICO MILLS, FRANKLIN, N. J. *Proprietors*—Stitt & Underhill, 152 Chambers street, New York. *Selling Agents*—Kendall, Opdyke & Co., Nos. 50 and 52 Franklin street, New York. 1 piece six-fourths brown and gold silk mixed cassimeres; 1 piece six-fourths dahlia and gold silk mixed cassimeres; 1 piece six-fourths black and white silk mixed cassimeres.

No. 48.—HARRISON MILLS, FRANKLIN, N. J. *Proprietors*—B. Underhill & Co., 152 Chambers street, New York. *Selling Agents*—Kendall, Opdyke & Co., Nos. 50 and 52 Franklin street, New York. 1 piece six-fourths black and white silk mixed cassimere.

No. 49.—MOHAWK MILLS, LITTLE FALLS, N. Y. *Proprietors*—Stitt & Underhill, 152 Chambers street, New York. *Selling Agents*—Kendall, Opdyke & Co., Nos. 50 and 52 Franklin street, New York. 1 piece six-fourths brown and gold silk mixed cassimere; 1 piece six-fourths dahlia and gold silk mixed cassimere; 1 piece six-fourths black and white silk mixed cassimere.

No. 50.—WORUMBO MANUFACTURING CO., LISBON FALLS, ME. *Treasurer*—Galen C. Moses, Bath, Me. *Selling Agents*—Almy & Co., Nos. 65 Leonard street, New York, and 38 Franklin street, Boston. 1 piece Alaska brown beaver; 1 piece Alaska dahlia beaver; 1 piece Alaska black beaver; 1 piece Alaska J. blue beaver; 1 piece Worumbo dahlia beaver; 1 piece Worumbo blue beaver; 1 piece Worumbo black beaver; 1 piece Worumbo brown beaver.

No. 51.—CENTRAL MILLS, UXBRIDGE, MASS. *Proprietors*—Day & Chapin, Providence, R. I. *Selling Agents*—J. C. Howe & Co., Nos. 67 and 69 Worth street, New York. 9 pieces three-fourths fancy cassimeres, plaids.

No 52.—ELBA WOOLEN MILLS, PROVIDENCE, R. I. *Proprietors*—Day & Chapin, Providence. *Selling Agents*—J. C. Howe & Co., Nos. 67 and 69 Worth street, New York. 10 pieces three-fourths fancy cassimeres, in mixed stripes and plaids.

No. 53.—PLYMOUTH WOOLEN COMPANY, THOMASTON, CT. *Treasurer*—John M. Wardwell, Thomaston. *Selling Agents*—Josiah Colby, 93 Leonard street, New York. 5 pieces three-fourths black doeskins.

No. 54.—DAMONDALE MILLS, CONCORD, MASS. *Proprietors*—Damon, Smith & Co., Concord. *Selling Agents*—Dale, Brothers & Co. 1 piece four-fourths Concord shaker white flannel; 1 piece four-fourths fine shaker white flannel; 1 piece four-

fourths Damon's original domett white flannel; 1 piece four-fourths fine white flannel; 2 pieces three-fourths fine domett white flannels; 1 piece three-fourths fine shaker white flannel; 2 three-fourths pieces fine white flannels.

No. 55.—ALMON HARRIS & SONS, FISHERVILLE, N. H. *Selling Agents*—Faulkner, Kimball & Co., Nos. 53 and 55 Worth street, New York and Franklin street, Boston. 2 pieces 27-inch H.A.F. plain orange flannels; 2 pieces 27-inch H.A.F. plain scarlet flannels; 2 pieces 27-inch H.A.F. A.A. plain scarlet flannels; 2 pieces 27-inch H.A.F. A.A. plain orange flannels; 2 pieces 27-inch H.A.F. A.A. twilled scarlet flannels.

No. 56.—B. F. & D. HOLDEN, WEST CONCORD, N. H. *Selling Agents*—Parker Wilder & Co., Nos. 62 Leonard street, New York, and 4 Winthrop Square, Boston. 2 pieces Concord C XX royal blue twilled flannels; 4 pieces Concord C XX scarlet twilled flannels; 6 pieces Concord (E) scarlet plain flannels; 6 pieces Concord (F) scarlet plain flannels; 2 pieces D. W. royal blue twilled flannels; 2 pieces D. W. gentinelle twilled flannels; 2 pieces D. W. scarlet twilled flannels.

No. 57.—CHARLES A. STEVENS, WARE, MASS. *Selling Agents*—Dale, Brothers & Co., Nos. New York, and Franklin street, Boston. 6 pieces four-fourths Ware best white flannels; 2 pieces four-fourths superior silk warp white flannels; 2 pieces three-fourths blue opera flannels; 1 piece three-fourths red opera flannels; 1 piece three-fourths purple opera flannels; 1 piece three-fourths white opera flannels.

No. 58.—ASSABET MANUFACTURING COMPANY, ASSABET, MASS. *Agent*—A. Maynard. *Treasurer*—T. Quincy Browne, 37 Lewis Wharf, Boston. Salesroom, No. 90 Franklin street, New York. 16 pieces three-fourths Rob Roys; 3 pieces six-fourths French flannels; 12 pieces three-fourths French flannels; 2 pieces three-fourths striped French flannels; 1 piece six-fourths striped French flannels; 1 piece four-fourths white French flannels; 1 pair 80 by 90 French blankets; 1 single fancy horse blanket; 2 pairs 48 by 58 crib blankets.

No. 59.—KALMIA MILLS SEYMOUR, CT. *Agent*—Julius Gerson, No. 361 Broadway, New York. 12 boxes different styles embroidered lily skirts.

No. 60.—TROY MANUFACTURING COMPANY, COHOES, N. Y. *Selling Agents*—Kutter, Luckemeyer & Co., Nos. 61 and 63 Worth street, New York. ½ dozen standard white ribbed shirts; ½ dozen standard white ribbed drawers; ½ dozen plain white wool shirts; ½ dozen plain white wool drawers; ½ dozen ribbed white wool shirts; ½ dozen ribbed white wool drawers; ½ dozen plain 2-thread heavy white wool shirts; ½ dozen plain 2-thread heavy white wool drawers; ½ dozen plain scarlet all wool shirts; ½ dozen plain scarlet all wool drawers.

No. 61. RIVERSIDE MILLS, COHOES, N. Y. *Treasurer*—Bogue & Wager, Cohoes. *Selling Agents*—Farnham, Gilbert, & Co., Nos. 59 Leonard street, New York, 149 Devonshire street, Boston, and 232 Chestnut street, Philadelphia. 1 dozen gents' violet clouded shirts, fine finish; 1 dozen gents' violet clouded drawers, fine finish; 1 dozen gents' violet clouded ribbed shirts, fine finish; 1 dozen gents' violet clouded ribbed drawers, fine finish; 1 dozen gents' heavy ribbed orange shirts, opera finish; 1 dozen gents' heavy ribbed orange drawers, opera finish; 1 dozen gents' heavy ribbed Shetland shirts, opera finish; 1 dozen gents' heavy ribbed Shetland drawers, opera finish; 1 dozen gents' blue mixed shirts, extra stout; 1 dozen gents' blue mixed drawers, extra stout; 1 dozen gents' oriental shirts, assorted sizes; 1 dozen gents' oriental drawers, assorted sizes.

No. 62.—ONTARIO MILLS, COHOES, N. Y. *Proprietors*—Chadwick & Co., Cohoes. *Selling Agents*—Faulkner, Kimball & Co., Nos. 59 Leonard street, New York, 149

Devonshire street, Boston, and 232 Chestnut street, Philadelphia. 1 dozen gents' plain orange mixed shirts; 1 dozen gents' plain orange mixed drawers; 4–12 dozen gents' all wool cochineal scarlet shirts.

No. 63.—MOHAWK MILLS, COHOES, N. Y. *Proprietor*—S. Billrough, Cohoes. *Selling Agents*—Farnham, Gilbert & Co., Nos. 59 Leonard street, New York, 149 Devonshire street, Boston, and 232 Chestnut street, Philadelphia. 1 dozen gents' super heavy plain merino shirts; 1 dozen gents' super heavy plain merino drawers; 1 dozen gents' fine plain merino shirts; 1 dozen gents' superfine plain merino drawers; ½ dozen ladies' fine silk finish vests; ½ dozen ladies' fine silk finish drawers.

No. 64.—TIVOLI HOSIERY MILLS, COHOES, N. Y. *Proprietors*—J. Root's Sons, Cohoes. *Selling Agents*—Farnham, Gilbert & Co., Nos. 59 Leonard street, New York, 149 Devonshire street, Boston, and 232 Chestnut street, Philadelphia. 1 dozen gents' heavy ribbed Shetland mixed merino shirts; 1 dozen gents' heavy ribbed Shetland mixed; 1 dozen gents' McClellan shirts, indigo cloud; 1 dozen gents' McClellan, drawers, indigo cloud; 1 dozen gents' plain clouded indigo mixed merino shirts; 1 dozen gents' plain clouded indigo mixed merino drawers; 1 dozen gents' heavy white superior patent merino ribbed shirts, extra finish; 1 dozen gent's heavy white superior patent merino ribbed drawers, extra finish; ½ dozen gents' Alaska shirts, improved white merino; ½ dozen gents' Alaska drawers, improved white merino; 2 dozen gents' extra heavy white superior patent merino shirts, extra finish; 2 dozen gents' extra heavy white superior patent merino drawers, extra finish; ½ dozen gents' superior English merino vests, extra finish; ½ dozen gents' superior English merino drawers, extra finish; ½ dozen gents' superior patent merino vests, silk finish; ½ dozen gents' superior Saxony wool vests, silk finish; ½ dozen boys' patent merino shirts, silk finish; ½ dozen boys' patent merino pantaloon drawers; 2 dozen ladies' merino vests; 1½ dozen ladies' merino pants.

No. 65.—C. H. ADAMS, COHOES, N. Y. *Selling Agents*—Storrs Brothers, No. 121 Chambers street, New York. 1½ dozen gents' plain white shirts; 1½ dozen gents' plain white drawers; ½ dozen gents' fine ribbed merino shirts, extra finish; 1½ dozen gents' fine ribbed merino drawers, extra finish; 1 dozen gents' fine ribbed merino shirts, silk finish; 1½ dozen ladies' cashmere vests, H. N. L. S.; 1 dozen ladies' cashmere drawers, full pattern.

No. 66.—NORFOLK AND NEW BRUNSWICK HOSIERY COMPANY, NEW BRUNSWICK, N. J. *President*—Lucius P. Porter, New Brunswick. *Secretary and Treasurer*—J. Earle, New York. *Selling Agents*—H. J. Libby & Co., Nos. 47 and 49 White street, New York. 6½ dozen gents' white shirts, different sizes; ½ dozen gents' scarlet shirts; ½ dozen gents' Shetland shirts; 4½ dozen gents' white pants, different sizes; ½ dozen gents' scarlet pants; 1½ dozen boys' white shirts different sizes; 1 dozen boys' white pants, different sizes; 2 dozen ladies white vests, different sizes; 2 dozen ladies' white drawers, different sizes; 5 dozen misses' white vests, different sizes; 1 dozen misses' white drawers, different sizes; 2 dozen children's pantalets, different sizes; 1 dozen men's Shetland half-hose; 1 dozen men's gray half-hose; 1 dozen men's white half-hose; 1 dozen men's scarlet half-hose; ½ dozen men's Shetland hose; ½ dozen men's gray hose; 2 dozen ladies' hose; 2 dozen Shetland half-hose, different sizes; 1½ dozen scarlet half-hose, different sizes; 1 dozen gray half-hose; ½ dozen Union dresses; ½ dozen Union dresses, Shetland; ½ dozen gents' gauze wrappers; ½ dozen Russian gored skirts.

No. 67.—GLASTENBURY KNITTING COMPANY, GLASTENBURY, CT. *Agent*—Edward Holt. *Selling Agents*—Townsend & Yale, 90, 92 and 94 Franklin street, New York.

½ dozen superfine clouded merino drawers; ½ dozen superfine clouded merino shirts.

No. 68.—I. DRYFOOS & COMPANY, 292 BROADWAY, NEW YORK. 9 Princesse de Metternich skirts; 1 black braided felt skirt; 2 printed felt skirts.

No. 69.—NEEDHAM HOSIERY COMPANY, NEEDHAM, MASS. *Selling Agents*—Chaffee & Shreve, 96 Franklin street, New York. A line of regular made wool hosiery.

No. 70.—CHAFFEE & SHREVE, 96 FRANKLIN STREET, NEW YORK. *Selling Agents* for Clifton Company, Cohoes, N. Y. Exhibit ½ dozen each; 415 fine white knit shirts and drawers; 424 plain Shetland shirts and drawers; 425 plain orange shirts and drawers; 426 plain violet shirts and drawers; 422 ladies' vests; 423 ladies' pants.

No. 71.—JAMES H. PRENTICE. *Selling Agents*—Jenkins, Vail & Peabody, No. 46 Leonard street, New York. 16 Boulevard seamless skirts, Boynton's patent.

No. 72.—LOWELL MANUFACTURING COMPANY, LOWELL, MASS. *Treasurer*—D. B. Jewett. *Selling Agents*—George C. Richardson & Co., Nos. 113 and 115 Worth street, New York, and Devonshire street, Boston. 122 pieces lastings, in three qualities; 18 pieces green reps and serges; 10 pieces ingrain three ply carpets; 12 pieces ingrain two ply carpets.

No. 73.—CHAFFEE & SHREVE, 96 FRANKLIN STREET, NEW YORK. *Selling Agents* for the following Mills:

PENN KNITTING MILLS, KENSINGTON, PA. *Proprietor*—Joseph D. McKee. Exhibit the new style of light fancy woolen cloaks known as the "Arab;" also a line of fancy knit nubias.

AMERICAN KNITTING COMPANY, PHILADELPHIA, PA. *Proprietor*—Harry Taylor. Exhibit light cloaks known as "Bedouin," in stripes and plaids; also Shetland nubias, opera hoods and fancy boas.

KENTON KNITTING MILLS. *Proprietors*—F. W. & T. S. Henson, Germantown, Pa. Exhibit a line of fancy knit hoods, of which article they make a specialty.

ARMAT MILLS, GERMANTOWN, PA. *Proprietor*—Elias Birchall. Exhibt a line of fancy knit hoods, in various styles.

No. 74.—ISAAC STEAD, MANUFACTURER, PHILADELPHIA, PA. *Selling Agents*—Churchill & Rhodes, No. 44 White street, New York. 2 pieces green Union terry; 1 piece Wood Union terry; 1 piece crimson Union terry; 5 pieces striped reps, green; 3 pieces striped reps, solferino; 2 pieces striped reps, tan; 1 piece striped reps, scarlet.

No. 75.—HARTFORD CARPET COMPANY, THOMPSONVILLE, CT. *Treasurer*—George Roberts, Hartford, Ct. *Selling Agents*—H. G. Thompson & Co., No. 29 Chambers street, New York. 11 pieces Brussels carpets; 10 pieces 3 ply ingrain carpets; 8 pieces 2 ply ingrain carpets.

No. 76.—GLEN ECHO MILLS, GERMANTOWN, PA. *Proprietors*—McCallum, Crease & Sloan, Germantown. 12 pieces ingrain carpets, of various patterns and colors.

No. 77.—E. S. HIGGINS & COMPANY, NEW YORK. 1 piece velvet tapestry carpet; 17 pieces tapestry Brussels carpets; 2 pieces body Brussels carpets.

No. 78.—ROXBURY CARPET COMPANY, BOSTON, MASS. *Treasurer*—J. W. Blake, 119 Milk street, Boston, Mass. *Agent*—M. H. Simpson, 119 Milk street, Boston. 3 pieces tapestry velvet carpets; 6 pieces tapestry Brussels carpets; 7 carriage robes.

No. 79.—ALEXANDER SMITH & SONS, MANUFACTURERS, YONKERS. N. Y. *Selling Agents*—A. T. Stewart & Co., Broadway, Reade, and Chambers streets, New York. 5 pieces patent power loom Axminster carpets; 1 specimen piece patent tapestry ingrain carpets.

No. 80.—The Crossley Company, Manufacturers, Bridgeport, Ct. *Selling Agents*—J. & J. W. Crossley & Co., 338 Broadway, New York. Display a large assortment of printed felt crumb-cloths, reps, carriage robes, in various designs and patterns.

No. 81.—Bigelow Carpet Company, Clinton, Mass. *Treasurer*—Charles A. Whiting, No. 16 Kilby street, Boston, Mass. Warehouse, No. 65 Duane street, New York. William B. Kendall, *Agent*. 10 pieces Brussels carpets; 4 pieces Wilton carpets; 3 Wilton rugs; 6 Wilton mats.

No. 82.—Schofield, Capron & Company, Manufacturers, Walden, N. Y. *Selling Agent*—Wisner H. Townsend, 20 Reade street, New York. Display a large variety of fine plaid woolen shawls in every variety of coloring.

No. 83.—Kalmia Mills, Seymour, Ct. *Manager and Selling Agent*—Julius Gerson, 361 Broadway, New York. 1 piece all wool damask, green and crimson; 1 piece all wool damask, green; 1 piece all wool damask, blue; 1 piece all wool damask, crimson; 1 piece all wool damask, drab; 1 piece all wool damask, crimson; 1 piece union damask, crimson and black; 1 piece union damask, crimson and black; 1 piece union damask, green and black; 1 piece union damask, crimson and black; 1 piece union damask, green and black; 12 ends figured union damask, all in different colors and designs; 1 piece striped union damask, crimson and green; 1 piece striped union damask, crimson and black; 11 ends striped union damask, all in different colors and designs; 1 piece striped union reps, tan; 1 piece striped union reps, crimson; 1 piece striped union reps, green; 1 piece striped union reps, green; 1 piece striped union reps, crimson; and an assortment of silk cotelines, figured in crimson, blue, dark and light green, maroon, brown, drab, and fawn colors.

AMERICAN BUNTING.

No. 84.—United States Bunting Company, Lowell, Mass. *Agent*—D. W. C. Farrington. *Selling Agents*—Theodore Polhemus & Co., 13 and 15 Lispenard street, New York. A large variety of American standard and Eagle bunting, in all colors and widths, for flags, railway signals, and decorations.

No. 85.—Rittenhouse Woolen Company, Germantown, Pa. *Agent*—Charles H. Ammidown, Germantown. *Selling Agents*—Ammidown, Lane & Co., Nos. 87 and 89 Leonard street, New York. 2 pairs medium white blankets; 2 pairs fine white blankets; 4 pairs superfine white blankets; 4 pairs mixed gray blankets.

No. 86.—Tremont Carpet Mills, Frankford, Pa. *Agent and Manager*—Israel Foster. *Selling Agents*—Larned & Starr, 116 Chestnut street, Philadelphia. 1 piece imperial three-ply carpet; 1 piece extra superfine; 1 piece stair carpet.

No. 87.—Star Knitting Mill, Cohoes, N. Y. *Agent*—A. G. Clark. *Selling Agents*—Petrie & Co., 75 and 77 Leonard street, New York. 2½ dozen ladies' white merino vests; 1 dozen ladies' white merino vests, assorted; 1 dozen men's white shirts, assorted; 1 dozen men's drawers, assorted; 8-12ths dozen men's shirts, assorted; 8-12ths dozen men's drawers, assorted; 6-12ths dozen men's shirts, assorted; 6-12ths dozen men's shirts, assorted.

No. 88.—American Worsted Co., Woonsocket, R. I. *President*—George C. Ballou. *Treasurer*—R. G. Randell. Large variety worsted coat binding, alpaca and mohair braids.

No. 89.—Germania Mills, Holyoke, Mass. *Resident Agent*—Aug. Stursberg. *Treasurer*—I. G. Mackintosh. *Selling Agents*—H. & A. Stursberg & Co., 97 and 99 Reade street, New York. 2 pieces blue wool-dyed Eskimo.

MACHINERY.

No. 90.—THOMAS A. CAMPBELL, 44TH STREET, 11TH AVENUE, NEW YORK. Attachment to wool carding machine, for oiling wool in the form of mist or spray without dripping or waste.

No. 91.—C. L. GODDARD, No. 3 BOWLING GREEN, NEW YORK, Inventor and Manufacturer. 1 Mestizo burr-picker; 1 single burr-picker burring machine for card machines; 1 double burr-picker burring machine for card machines; 1 pair plane feed rolls, for plane machines; 1 pair intersecting rolls, for plane machines; new model for making card cylinders.

No. 92.—H. W. BUTTERNUT & SON, PHILADELPHIA, PA., *Manufacturers.* 1 cylinder calendar roll machine, for drying woolen or cotton yarn.

No. 93.—CHAPIN & DOWNES, PROVIDENCE, R. I., Patentees and Manufacturers of Houget's Patent Double Cylinder Longitudinal Gig, and Zschille's Patent Cross Raising Gig. 1 patent double cylinder longitudinal gig; 1 patent cross raising gig.

No. 94.—C. G. SARGENT, GRANITEVILLE, MASS., *Manufacturer.* 1 wool burr machine; 1 metallic waste card, for working up spinners' and weavers waste.

No. 95.—S. R. PARKHURST, MANUFACTURER, NEWARK, N. J. Single and double burr machine, with patent steel ring-feed rollers; also, patent double cylinder burr-picker and mixing-picker, for all grades of wool; one patent double cylinder cotton-gin.

SOAPS.

No. 96.—GLAMORGAN SOAP COMPANY, NEW YORK. Agency salesroom, 79 Trinity Place. Large assortment of soap for cotton, woolen, and silk manufacturers' use; sample cases of toilet and laundry soaps; 3 barrels savonine, a concentrated soap powder for general scouring purposes, washing wool, woolen goods, etc.

CARD CLOTHING.

No. 97.—RUFUS SARGENT, AUBURN, N. Y. 3 sample cases machine card clothing.

LEATHER BELTING.

No. 98.—BICKFORD, CURTISS & DENNING, MANUFACTURERS, BUFFALO, N. Y. 5 rolls leather belting.

THIRTY-EIGHTH ANNUAL EXHIBITION.

Historical Sketch of the Institute—Grand Opening of the Fair—Addresses by Orestes Cleveland and Horace Greeley.

The following account of the opening is taken from the New York *Tribune:*

"No society on the continent has done more to make the products of American ingenuity known and honored throughout the land than the Institute which last evening for the thirty-eighth time flung open its doors and invited the public to a grand industrial exhibition. Commencing in small rooms, and with aims homely and practical, this society has, for two-score years, constantly grown in usefulness, in the scope of its activities, and in wealth. Its Trustees are among the ablest business men of the metropolis. Its Board of Managers is made up of successful merchants and professional men, with enough of the thrift of the counting-room, combined with the enthusiasm of the inventor, to secure in its action spirit, enterprise, and devotion to scientific progress. These annual exhibitions have now assumed such proportions as to make a prominent feature of city life each autumn. One sees here a grand bazaar where everything new, useful, brilliant, ornamental, or curious is displayed before him. No sales take place at these fairs, but they greatly promote traffic, and scatter far and wide a knowledge that such combinations exist, such wares can be commanded. The increase of the metropolis and the number of interests here represented throws a yearly increasing embarrassment upon the Directors of the Institute to provide a building capacious enough for its exhibitions. For some years the location has been on Fourteenth street. But it has outgrown the spread of any roof in that part of the city. The gains of each fair have been wisely invested so that now the Institute can reasonably hope for the realization of a plan long labored for by the Directory, that of erecting a structure not smaller than the Crystal Palace of 1852, where all novelties of development, of science, of the useful and ornamental arts, may find welcome, appreciation, and notice.

Each year the Legislature of the State sends out nearly 10,000 copies of the Institute's Transactions, a volume of over 1,000 pages, a full and able record of the last discovery, the best summary, the most practical current knowledge in applied science and in agriculture. This series of volumes is a library of American science and discovery, the record of what we have planned, what we have projected, and what accomplished. The American Institute is, on the whole, the fullest illustration in what it has done and what it plans of the development of the philosphy of uses, of those arts and methods by which man proposes to complete his mastery of the material world.

The fair opened promisingly last evening, although the weather was decidedly unpropitious and the inscrutable dilatoriness of many of the exhibitors had made it quite impossible to bring perfect order out of the chaos. The scene was decidedly picturesque and interesting, and the lofty arches of the rink glittered with hundreds of gas-lights, the long rows of white-topped tables, curtained with colored muslins, the scores of well-filled cases scattered through the room, the hundreds of visitors strolling along the aisles and among the alcoves, and the sweet strains of Thomas's orchestra, all combined to make one forget that confusion still lingered in all the departments, that a vigorous use of the broom would have improved many a corner, and that much must be added and altered before the fair will reach its best estate. The prismatic illumination in front of the rink was not lighted, and it was late in the evening before a single one of the large sun-light reflectors flung its powerful radiance on the scene. When the three or four others are in place the light will be all that can be desired."

The Hon. Orestes Cleveland, chairman of the Board of Managers, called the meeting to order and introduced Mr. Greeley, the orator of the evening.

SPEECH OF THE HON. ORESTES CLEVELAND.

We propose, now, to formally declare this exhibition open. You will observe that many of the articles brought here for exhibition are not yet prepared, but most of you are aware that in the opening occasions of this kind natural delays occur, and no exhibition in any part of the world has ever been entirely complete upon the day of its opening. But this Institute, after discussing the matter has decided to open its exhibition promptly at the time advertised, ready or not

ready. [Applause.] We believe that in the course of a few days we shall present to you an exhibition worthy of this Institute, worthy of this great city, and worthy of this great nation. We believe we shall present to you an exhibition unequalled before in this country; in certain departments, never before attempted. We have here, in the woolen department, the National Association of Wool Manufacturers, who have come here, and will exhibit to you fabrics not excelled in any part of the world. [Applause.] We do not hesitate to say so. We believe that the verdict of those who make examination will bear us out in the assertion. There are other items of interest in this exhibition, useful and ornamental articles to be examined, novel inventions, many very important and prominent things. But we will not detain you. We will leave you to examine the exhibition when it is finally prepared for your examination. We gather together here the manufacturer and producer from all parts of the country. The rich man and the poor man equally come here for the fostering care and protection of the American Institute. [Applause.] The great capitalist comes here exhibiting his product. The inventor despondent, weary, almost despairing of being able to bring his invention before the public, comes here and we take him by the hand, and introduce him to the great mass of the people. [Applause.] The poor mechanic who is unable to make his product known comes here with the labor of his own hands, and we take him just as heartily in our embrace, care for him and treat him just as well as we do the wealthiest manufacturer. Like the works of nature, the American Institute sheds abroad its benefits upon all classes and kinds of people all over the country. [Applause.] We shall now have the pleasure of introducing to you the orator of the evening, Mr. Greeley, the President of the Institute. [Long continued applause.]

MR. GREELEY'S ADDRESS.

Ladies and Gentlemen.—The American Institute has invited you to assist it in celebrating the fortieth anniversary of its origin; the close of forty years of persistent, earnest, zealous efforts for the development of American industry. Its thirty-eighth fair, now open, would have been its forty-first but for the fact that the rapid and vast growth of American manufacturing and mechanical arts have utterly outrun the expansion of our means and of the facilities of any kind for the proper and adequate exhibition of the improved pro-

cesses and significant trophies of our country's industrial art and proficiency. We trust in good time—I wish I could say in a short time—to welcome you in an edifice of our own [cheers], an edifice, not so large as this but at least better adapted to our purposes. And in that edifice we hope to celebrate the 100th anniversary of American independence [cheers] by an exhibition of American art and American skill at which no American need blush, and upon which all Europe might well congratulate us. [Loud cheers.] Understand, friends, that our managers, and they are not a few, have been faithfully at work for a whole week producing what you see around you. We have not been able to bring the exhibition to the state in which we hoped to present it on this opening day; all we can say is that the best has been done, and that a few days more will make it such an exhibition of American art and industry as no American ever yet saw. [Cheers.]

The first exhibition of the American Institute that I attended was held thirty-seven years ago in the Masonic Hall in Broadway, near Duane street. A room, perhaps fifty feet by 100, contained it all; now twenty such rooms would be utterly insufficient. We were compelled to accept a room most remote from, and inconvenient to, the mass of our population, since it was better to call you miles to see something than furlongs to see nothing. Forty years is not a long period, but it is longer than most of you who hear me have lived. As my recollection fully grasps this period of the lifetime of the Institute, let me endeavor briefly to set before you some of the changes which it—the period, not the Institute—has wrought in the condition of the civilized world. Though its wars and battles have been less numerous, less important, and less destructive than those of the preceding forty, and though no great changes in the boundaries of States have been carved out in this period by the conqueror's sword, yet no other lifetime since the Christian era—unless it be that of one who as a boy heard of the invention of printing, and in the ripe fullness of his days read of the memorable discovery of a new world by Columbus—has been so full of events worthy to be held in remembrance and fraught with blessings to the entire human family. When this Institute was founded, forty years ago, the civilized world slumbered uneasily in the arms of what called itself legitimacy and divine right. Napoleon had ended his warlike career fifteen years before, and had died upon his rocky prison seven or eight years before; while Alexander of Russia, his mightiest antago-

nist, had perished four years before in the savage wastes of the southern part of his dominions. It was an era of prosperity and what seemed permanent glory. George IV, the first gentleman of Europe, in his youth a liberal, in his old age a despot, ruled still over the British empire. Charles X, the last of the regular Bourbons, was the absolute monarch of France, and seemed to his admirers and supporters as firmly fixed on the throne as ever Louis XIV was, though that throne was destined very soon to crumble and disappear in the roar of the barricades of February, 1830. Ferdinand VII the crafty, the treacherous, the tyrannous, reigned over Spain, which the Holy Alliance had given back into his hands after he had justly forfeited and lost his rule over it. It was the midnight of reaction, to be soon startled by the coming revolution, when our country only contained a population of 12,000,000, not one-third of its present inhabitants, and while its wealth was not one-fifth and its industry not more than one-fourth in productiveness of what it is to-day. Michigan was still a wooded territory with not half population enough to constitute a State. Illinois and Missouri were our most western free States with but a single representative each in Congress. St. Louis was the only place of any importance on the Missouri or upper Mississippi. Chicago was an inland trading post of perhaps half a dozen huts, and with less than 50,000 inhabitants, within a radius of 200 miles, where there are now more than 3,000,000 of civilized human beings. Iowa, Minnesota, and Kansas had not yet even names; but there was a river called Wisconsin, upon which some white men had cut timber, or were preparing or thinking of doing so. California was a Mexican territory, without industry, civilization, or hope, and with but a handful of people; very much like, in fact, what Alaska, is to-day. Two or three little sailing vessels visited that wild region once a year to buy the hides of its wild cattle, which consisted the only disposable wealth of its five or six thousand people. There may have been a few huts around the Golden Gate known to the Pacific coasters and North Sea whalers as Yerba Buena; but the name of San Francisco had never appeared on any map. Oregon was a British trapping and hunting ground, ruled by the Hudson Bay Company.

Steam had fully entered upon its conquering march. The genius of our own Fitch and Fulton had aided its development and applied it to inland navigation, and our great rivers were nightly lit up by the furnace fires of countless steamboats, the plash of whose paddles,

the cough of whose engines, had sometimes startled the sleeping deer even on the banks of the upper Mississippi. Boats made daily and nightly passages from New York to Albany in a little more than twelve hours. Toward the railroad, men had been blindly groping in the canal, in coal mines, and deeper dens for nearly a century; but the first locomotive that ever ran on an iron track and drew carriages filled with passengers behind it was made in England in the year 1829. And the first public trial of engines was made on the track of the railroad from Liverpool to Manchester, just as our first fair was opened in October, 1829; though the first regular trains of passengers were not established till the following year. The first three miles of iron track in America had been finished at Quincy, Mass., two years before, as a similar track, nine miles long, had been at Mauch Chunk, Penn. The former was designed for moving granite from the quarry to navigable water, as the latter was for the transportation of coal from hillside mines to a canal; but both were horse roads, and barely two locomotives had been imported into this country, and none set to work when our first fair was held. These were still employed in coal transportation. The first engine ever built in this country was completed in 1830, in which year locomotives began to carry passengers over short distances on bits of unfinished railroad in this State, in Pennsylvania, in Maryland, and possibly in North Carolina. The development of the railroad system, now extended to some forty thousand miles of track in this country, and a like number in Europe, at a cost fully equal to the aggregate wealth of our people forty years ago, has been effected within the lifetime of the American Institute. We stand as yet too near the origin of this application of steam and iron to secure at once celerity and cheapness in the movement of passengers and products, to accurately measure or fully appreciate its importance. We do not realize the difference between reaching Washington, Boston, or Utica in a few hours as we do, and being three long days in making the hard, racking, wearing journey to Albany, as I have done within the last thirty years. The consequent saving in time and cost is incalculably great; and our Pacific railroad, which has brought San Francisco within a week of New York, is but the first of a series of triumphs of man over giant obstacles which cannot be arrested till barbarism and mental stagnation are banished from the earth. The electric telegraph is years younger than the railroad. In its practical working condition it is barely a quarter of a century old. As

we concede precedence in the steam engine and the locomotive to Great Britain, and to France the daguerreotype, and all its progeny, so we must claim precedence for America in the steamboat and the electric telegraph; two of the mightiest agencies yet devised for the interchange of products, and the diffusion of ideas and intelligence. And very naturally nowhere else have these been so generally employed or so largely profited by as in these United States; and the vast change, whereby steam is now palpably superseding wind as a motive power for vessels on the high seas, though it has been mainly effected by Europeans, owed its chief impulse to the general demand for rapid and certain, as well as cheap transportation of costly wares and fabrics from western Europe to this country, and more especially to this port. The sewing machine, one of the beneficent marvels of our age, is not only thoroughly American in conception, application, and development, but it was so developed mainly through this city, aided by the wide intelligent appreciation which it obtained through the successive fairs of this Institute. This is but one of the many beneficent transformations which it has been the privilege of this association to aid in obtaining early and gainful recognition. And while the inventors and their supporters have thus been profited, the public has received a far larger and enduring benefit. Let us never doubt that the inventions and improvements that shall be—nay, that are even now at hand—will surpass in utility, and even in novelty and in the magnitude and pervasiveness of their effects, those which the last forty years have witnessed and accepted. Let us be prepared to welcome with generous appreciation discoveries and achievements which conflict with our conceptions, and even with our interests; and let us all, members and friends of the Institute, resolve that the little it has been able to do in the interest and for the development of American industry and skill in the years of its infancy and youth, shall prove but an earnest and foretaste of what it can and will do in its vigor and maturity, and under the inspiration of the noble efforts and grand achievements of those who in almost every department of industrial progress have honored the American name, while serving and blessing the whole family of man.

Friends of the Institute, I can but glance, nay, I cannot yet glance, at the novelties which this fair is destined to bring before you. I apprehend that the loom called the positive motor loom, which you will soon be observing and scrutinizing, is the greatest advance in the production of textile fabrics that has been made since Arkwright's

time ; and I don't forget that I speak in the presence of at least one very eminent improver of the loom. I believe that we are to exhibit specimens of products in iron and steel not yet accepted, not yet realized, but fully assured—inventions which will be on exhibition here in the Institute. So you will find in the sewing machine improvements on the past that have not been hitherto presented for your criticism ; and so in every department their are novelties of idea and of plans ; improvements and simplifications of processes. Thus it will be seen that industrial advancement is no work of gigantic strides before steady perseverance, never retreating in its steps, continually progressing through continual efforts. Such is the law of human advancement, and such, I trust, will be fully exemplified in the exhibition which we present for your scrutiny this evening. Let us hope and trust that the difficulty of location, which we have been unable to surmount, will not deprive us of the generous appreciation and enthusiastic support of the working men and women of New York ; that the friends of labor and the devotees of labor will recognize that this is their anniversary, that our triumphs are their triumphs, and that every blow struck at obstacles, everything which makes it a little easier to achieve some result in industry, in production, is a blow struck for every man who lives by labor, and a blow which promises ampler food and better clothing for the generation that is and the generation to come after. Friends and neighbors the fair is now open.

ADDRESS OF THE HON. SAMUEL S. FISHER,

OF WASHINGTON,

United States Commissioner of Patents, at the Thirty-eighth Annual Exhibition.

Ladies and Gentlemen.—I left Washington with no other object than to visit this exhibition, and extend the right hand of fellowship to those who are endeavoring to secure its success. I had no thought of speaking to you, and should have been glad if the managers had been willing to accept the seeing of the eye for the hearing of the ear. I bring you, therefore, no well-considered oration, but desire only to offer a few plain words of greeting, and a thought which it has occurred to me, this may be the proper time and place to express. Among the earliest reminiscences of my boyhood, are the fairs of the American Institute, which were held many years ago—so many that I fear to count them—in Niblo's and Castle Gardens. Of details I remember very little, except that there were models of ships and steamboats, and that two or three boys lost their fingers by injudiciously turning the horse-powers, and that everything wound up with fireworks, and a grand flight of rockets by Mr. Edge, of pyrotechnic fame. Once, indeed, at Castle Garden, I believe, the closing exercises were varied by omitting the fireworks, and substituting the bombardment of the Castle of San Juan D'Ulloa by the French, which mimic seige we converted into real earnest in a few years thereafter. From the character of these recollections you will see that I must have been very young indeed. One thing, however, was noticeable, even by my young eyes, and may be noticed now—that nearly every article in the fair bore upon it the imprint of that magic adjective, "patented." Those were the days just after the passage of the great patent act of 1836, which established what is now the distinctively American system in regard to the grant of letters patent, and yet already the patent office had become a power in the land, and was sheltering under its wings the little brood of new fledged American inventions. I have

said that the fact which I noticed in my boyhood may be noticed now. You cannot walk through any of these aisles, without finding in every niche, upon every table, above and around you, articles which have themselves been patented or are the product of patented processes or machines. I suppose, if upon your outer wall a banner were displayed, announcing that no article would be received for exhibition with the creation of which letter's patent had nothing to do, that very few of the many things upon exhibition here to-night would be stopped at the threshold by the prohibition. For this result, this and kindred institutes and associations are, in part, responsible; a responsibility, let me hasten to say, for which they need in nowise be ashamed. These great exhibitions—displays—advertisements—as I think one of your papers has called them, have made many an invention familiar to the public that would otherwise have remained unknown; have given many an impulse to some halting enterprise that would otherwise have failed to reach the goal; have called capital to the aid of genius, by showing to capital where it might profitably be employed. Many an inventor has grown famous, and many a manufacturer rich, through the medium of your expositions, the awards of your juries and the distribution of your diplomas and medals. The work of the patent office, and of all such societies as this, is one. It has for its purpose the protection and development of the inventive genius of our country. We are more especially charged with protection, you with development, or, as I suppose you would prefer to phrase it, our motto is, "Protection to American genius," while yours is "Protection to American industry." How both have prospered in their work may be learned by comparison of the earlier fairs of the Society with the present, and by a glance at the patent office reports. During the forty years that this Institute has been in existence, the department of huge vegetables, and of quilts with wonderful patchwork, has become sensibly smaller, while that of wonderful labor-saving machines and beautifully-wrought fabrics has become sensibly greater. (I believe I have seen a solitary pumpkin to-day.) In the days when I gazed with delight upon Mr. Edge's fireworks, the click of the sewing machine was never heard; electricity had not yet condescended to come out of the lecture room and enter the lists as a practical science; India-rubber, hard and soft, with its manifold applications, was a mere black and sticky plaster for shoes and ugly overcoats. We had the steam engine, as it came from Watt, and the steamboat as it was left by Fulton. As for these beautiful textiles, it

would have seemed madness to have dreamed that we should ever dare to dream of them thereafter. In the patent office, under the act of 1836, the commissioner and "one examining clerk," were thought to be sufficient to do the work of examining into the patentability of the two or three hundred applications that were offered. Now sixty-two examiners are over-crowded with work, a force of over three hundred employes is maintained, and the applications have swelled to over twenty thousand per annum. This year the number of patents granted will average 275 per week or 14,000 in the year. These numbers are so startling, when compared with the days of which I have been speaking, that people are sometimes ready, in their haste, to suppose that their must be something wrong about the system, and some have doubtless been prepared to join hands with a few of your disaffected cousins across the water, and to demand a repeal of the patent laws and the abolition of the system itself. It has occurred to me, that, standing here to-night as the official representative of this system, it would not be inappropriate for me to say a few words in its behalf. In the first place no comparison can properly be made between our system and that of other countries. In England and on the Continent all applications are patented, without examination into the novelty of the inventions claimed. In some instances the instrument is scanned to ascertain if it covers a patentable subject matter; and, in Prussia, some slight examination is made into the character of the new idea; but in no case are such appliances provided, such a corps of skilled examiners, such provision of drawings, models and books, such a collection of foreign patents, and such checks to prevent and review error as with us. As a result an American patent has, in our courts, a value that no foreign patent can acquire in the courts of its own country. This has rendered property in foreign patents exceedingly precarious. Such as are granted have not been subjected to examination; they have no *prima facie* weight. Yet they *may* be valid. It is true that no one knows this—not even the inventor; but the possibility that they may prove so makes them weapons in the hands of unscrupulous men, to frighten and coerce manufacturers who have very imperfect means, short of litigation, of arriving at the truth or falsehood of the self-asserted pretensions of the patentee. On the other hand, the inventor is in as much doubt as the manufacturer. He does not know what to claim as his invention. As he alone is to fix the limit, as there is to be no revision, he may claim much or lit-

tle—how much or how little he must always doubt. As a consequence foreign patents are of doubtful value, and the whole system has fallen into some disrepute. I suppose that the foreign patents of American inventors, that have been copies of patents previously granted in this country, are the best that are granted abroad, and I know that many an English or French invention, that has been patented without difficulty there, has been stopped in its passage through our office, by a reference to some patent previously granted in this country, or perhaps in the very country of its origin. In spite of our examination, which rejects over one-third of all the applications that are made; or, more properly, because of it invention has been stimulated by the hope of protection; and nearly as many patents will issue in the United States this year as in the whole of Europe put together, including the British isles. But a few days ago I took up a volume of Italian patents to see what progress the new kingdom was making in invention, when I was amused and gratified to find on every page the name of the universal Yankee, repatenting there his American invention, and, I suspect, much the best customer in the patent office of united Italy. The truth is, we are an inventive people. Invention is by no means confined to our mechanics. Our merchants invent, our soldiers and our sailors invent, our schoolmasters invent, our professional men invent, aye, and our women and our children invent. Cheap protection has been a fertilizer that has produced much growth of brain and much fruit of discovery. One man lately wished to patent the application of the Lord's Prayer, repeated in a loud voice, to prevent stammering; another claimed the new and useful attachment of a weight, or other article possessing gravity, to a cow's tail to prevent her from switching it while milking; another proposed to cure worms by extracting them by a delicate line and a tiny hook baited with a seductive pill; while a lady patented a crimping pin, which she declared might also be used as a paper-cutter, as a skirt supporter, as a paper file, as a child's pin, as a boquet-holder, as a shawl-fastener, or as a book-mark. Do not suppose that this is the highest flight which the gentler sex has achieved. It has obtained many other patents, some of which have no relation to wearing apparel, and are of considerable value. But, I am asked what proportion of all patented inventions prove to be valuable, to their projectors as to the public? One-tenth? Probably not much more than that; but, let it be remembered, there are few failures so harmless as that of a useless invention. The patent gives it a chance

to prove itself worthy of the public patronage. It simply declares that if it be good it shall not be stolen ; but if it be useless nobody will want to steal it. But of all those who enter upon any occupation of life, how many succeed and how many fail ? How many young men have entered the bar, and have failed to take rank with Evarts, O'Conor or Brady ? How many have launched their bark, laden with mercantile ventures, and have been stranded, while Claflin and Stewart have been sailing into port ? How many have been moved to " start a paper," who have lived as long but not to as much purpose as Raymond, Bennett or Greeley ? I suppose that nine failures to one success is a very fair proportion for the professions of the world, including that of the inventor ; or, at all events, I do not suppose that the failures among inventors are more numerous than among every other class of workingmen. As to property in inventions, I shall not stop to discuss it. That a man having, by long experiment, by patient thought, by brilliant genius, by the expenditure of time and of means, conceived and brought to perfection and embodiment some new idea—having created some new substance, put in motion some new machine, put some old force to new work, or given to some new force a field for labor, is not entitled to call this which he has done his own and to set his price upon it, need not, I think, be argued before honest men. If we owe nothing to the men who have made this century so illustrious by their great conceptions, then we owe nothing to anybody, and repudiation ought to be the watchword of the age. We do owe them much—not merely a debt of sentimental gratitude, but a debt payable in cash, which shall lift them above want, and place them upon such a pinnacle of happiness that the world shall say : " Thus shall it be done unto the man whom the nation delighted to honor !" How shall we give pecuniary consideration for inventions ? There are two ways in which this might be done. One is by the purchase, for cash, by the government, of all inventions, for the use of the nation. This plan is met, at the outset, by the impossibility of determining the value. Every inventor supposes himself to have a fortune in every conception that he puts into wood and iron. Stealing tremblingly and furtively up the steps of the patent office, with his model carefully concealed under his coat, lest some sharper shall see it and rob him of his darling thought, he hopes to come down those steps with the precious parchment that shall insure him a present competency and that shall enrich his children. I should think if he

were offered a million, in the first flush of his triumph, that he would hesitate about touching it without sleeping over it for a night. Yet fourteen thousand millions would be a pretty heavy bill to pay from a treasury not over full. Fourteen hundred millions might be thought an important addition to the national debt; or even one million four hundred thousand, which would be just one hundred dollars a piece for all the patented inventions of 1869. I think, therefore, that we may set aside the plan of purchase as impracticable. No commission could satisfy the inventor, and no price that we could afford to pay would take the place of the stimulus of the hope of unlimited wealth, which now lightens his toil and shines like a beacon at the entrance of the harbor that he hopes to make. The other plan is to offer protection for a limited time, in payment for the new discovery. We may say to the inventor, "You have a valuable secret which may benefit us; to disclose it without protection would be to lose it; to keep it would deprive us of its use. If you will disclose it to us by so describing it and illustrating it, as that we may fully understand it and may avail ourselves of it without difficulty, we will agree that for seventeen years you shall be protected in its use. You may make out of it what you can. When your limit of time has expired we shall have it without further payment. We cannot pay you in money, we will pay you in time." I submit that this is a fair bargain. A new thought developed, explained, described, illustrated, put on record for the use of the nation—this on the one side. The right to the exclusive benefit of this new thought for a limited time, and protection in that right—this on the other. This is the patent system. A fair contract between the inventor and the public—ideas paid for by time. It is manifest that the utmost good faith is required upon both sides. On the one hand there must really be an invention—no stealing of the ideas of other men, no crude notions resting only in experiment. The inventor must have something to sell. On the other hand there must be protection—no infringement, no piracy, no stealing of the soul of the invention by clothing it in immaterial changes of form. To secure this fair dealing we have, on the one side, the patent office, with its examiners, its drawings, its models, its books and its foreign patents, to scan and test the invention. On the other side we have the courts of law to protect the inventor and punish the thief. It is possible that these instrumentalities may do their work imperfectly. This may sometimes happen; but to the extent to which they do it, a fair

contract for an honest and useful purpose is made and is maintained. This is the American system. Under its protection great inventions have been born, and have thriven. It has given to the world the steamboat, the telegraph, the sewing machine, the hard and the soft rubber. It has reconstructed the loom, the reaping machine and the locomotive. It has trained up each trunk of invention until it has become a graceful tree with many branches, adorned with the fruits of many improvements and useful modifications. It has won from the older homes of the mechanic arts their richest trophies; and like Columbus, who "found a new world for Castile and Leon," it has created new arts, in which our nation has neither competitor nor peer. Without the protection of our patent laws, no such exhibition as this would have been possible. By far the greater number of the inventions which now crowd the shelves of the patent office would be missing. No doubt many weaklings would thus have been spared a contact with a cold and unfeeling world; but many vigorous children, that have come to a robust manhood, would have perished long since for want of sustenance. Men will not take the risk of introducing new inventions, of educating the public in their use, of overcoming opposition and prejudice, unless they can be assured of reasonable protection in their work until their capital has made return. They will not sow that others may reap, and, when the land is ready for the harvest, come forth with greater capital and more laborers, and thrust aside the pioneer who has borne the burden and heat of the plowing and cultivating. For the proper administration of such a system as I have attempted to sketch, it is manifest that much skill and honesty are needed in the patent office, in all its departments. Speaking for the gentlemen associated with me, I believe them to be both skillful and honest. They pass in review many valuable interests. They are attended by a body of skillful practitioners. They are beset by an array of eager inventors. If in the examination of twenty thousand applications they made no errors, they would deserve statues of gold. That they make no more, and that in all these years and in all their number well-founded charges of corruption have been few and far between, is a strong tribute to their integrity and ability. On behalf of this great American bureau of invention, I bring you greeting to-night; on behalf of the one hundred thousand American inventors whom it represents, I bespeak for it your cordial support and sympathy.

AMERICAN AGRICULTURE.

ITS PROGRESS IN THE UNITED STATES.

BY DR. GEORGE B. LORING OF SALEM, MASS., AT THE EXHIBITION.

DELIVERED ON SATURDAY AFTERNOON, OCTOBER 2, 1869.

Mr. President and Gentlemen.—American agriculture is yet in its infancy. Covering as it does a large section of the earth's surface, devoted to every variety of soil, influenced by a great diversity of climate, obedient to many different markets, it has hardly yet been so systematized as to present on many acres the most economical and profitable husbandry to which those acres are adapted. A comparatively new civilization, an abundance of new lands, the attractions of other branches of business are undoubtedly the causes of this tardy development. And we now find ourselves, with a very respectable agricultural record behind us, suddenly confronted by the imperative necessity for an accurate, methodized, well-organized system of husbandry, in which our expensive labor and capital may be profitably employed, and in which all the modern obstacles, an impoverished soil, clouds of destructive insects, the diseases of vegetable life, all unknown to our ancestors, may be overcome. We have had our share of success, it is true. And the rude husbandry, with which our former generations were familiar, not only produced extraordinary crops, but when commerce was small and manufactures were unknown, it constituted the chief wealth of our nation, and gave it all the financial success which crowned the efforts of the early administrations. From the beginning until now, however, our agriculture has been conducted in a manner unknown to almost every other people ; and the enterprise which is applied here is not applied elsewhere. I do not mean to say that equally good and even better agriculture has not been found with other nations. The farming of China, of Lombardy, of Holland, of England, would refute such statement at once. Considering the latitudes which it covers, it is

possible that the agricultural products of Russia, may exceed our own. The wealth which France has drawn from her soil is marvelous. And Japan and Hindostan have astonished the world with the diligence and activity and skill with which the soil of those countries has been cultivated, and has been forced to pour forth all its resources by the application of fertilizers of every description. But we should bear in mind that the agriculture of all these countries is conducted by classes of people who are forced into a subservient order in society. The land itself, in many of them, is held in large estates, and is tenanted by a class whose chief business it is to direct those operations on the land, which are to yield them an ample return for the capital invested. It is so in Russia, where labor is wholly subservient to capital, and where the division of the empire into small estate, is impossible. It is so in England, where the laborer is merely a tenant, and makes his arrangements under the eye of a landlord. It is so in France, even where, notwithstanding the division of the territory into small estates, the whole business of farming is conducted by *sabots*, that rural population of France who, even within a half league of all the wealth and refinement of Paris, retain all their ignorant rusticity, and cover the kingdom with the inanimate atmosphere of the most primitive and least ambitious modes of agriculture. It is the kings and princes, the nobility and families of distinction, who draw their income from the land, and who vie with each other in the agricultural exhibitions. The small farmers follow their lead. Wherever great agricultural improvements are made it is under their patronage. It has been said, for instance, of the cultivation of the turnip in England: "On the value and importance of the turnip crop to England it is unnecessary to expatiate. Not only does it enable the farmer to supply the consumer with fresh meat during the winter, instead of the salted food upon which our ancestors had almost exclusively to depend, but also partially supplies the place of a fallow; it imparts to the land a degree of fertility which, under proper management, secures a succession of crops for the following years of rotation. It is indeed the sheet anchor of light soil cultivation, and the basis of the alternate system of English husbandry, to which every class of the community is so much indebted." And yet so slow was the English farmer to adopt this root as an article of field culture, that the zeal with which Lord Townshend urged its cultivation and set forth its importance, won for him the name of "Turnip" Townshend, in derision; and nothing but his position and wealth

enabled him to carry his point. It was the Duke of Bedford who first introduced plowing with two horses abreast into the region about Woburn. The introduction of the fine breeds of cattle and sheep, which Bakewell and Culley and Charles Colling brought to perfection, has been encouraged and fostered most carefully by those who hold in their hands the wealth and the titles of England, the Duke of Bedford, Lord Somerville and others. The valuable system of drainage laid down by Smith of Deanston, found its earliest and most enthusiastic advocates in the Duke of Portland and the Marquis of Tweeddale. And the work performed by these men has not been easy. The agricultural community has, in the end, followed their lead, but they have been obliged to overcome all those prejudices which will always prevail where a large portion of the people are deprived of the benefits of education. "In the dark ages of superstition, a man, who by any improved method contrived to grow larger crops than his fellows, was supposed to use supernatural means; and if he escaped prosecution as a wizard, was at least shrewdly suspected of dealing with a power whom his more pious neighbors carefully avoided." On the introduction of hops into England, the City of London petitioned against their use, lest they should injure the beer; and with equal wisdom the Kentish farmers, whose lands where overrun with coppice, and who are now so largely benefited by the cultivation of hops, objected to their growth, because they occasioned "a spoil of wood for poles." New implements of husbandry have been opposed there much upon the same principle as the objection made a century ago in Scotland, and so humorously described by Walter Scott, to the use of the winnowing machine, which was considered an implement for thwarting the will of the Divine Providence, by raising the wind on its own account, and which was publicly denounced in the pulpit as impious. And almost to the present time in one county in England the farmers assigned as the reason for making the hinder wheels of their wagons preposterously larger than the fore-wheels, that it places the body on a level going up hill. While, therefore, large intelligence and capital are employed in improving the agriculture of England, the great mass of the population are slow to accept the advantages which intelligence seizes upon with avidity. This same condition of things exists on the continent of Europe. The great mass of the cattle of the various European countries, Hungary, Switzerland, Italy, Holland, Spain, retain the characteristics which were to be found there long ago. But little has been done to remove

their defects by careful breeding and feeding; and the progressive farmer seldom goes to those countries for those breeds which have been developed into the best proportions and quality for specific purposes. The plows of Lombardy do not differ much from the plows used there in the days of Virgil. The lands is managed, the seed is placed in the earth, and the crops are gathered now much as they were centuries ago in France. There has been but little change either in the value or in the quality of the labor employed. When intelligence is low and labor cheap, and the husbandman expects but a small reward, and individual ambition is chilled by the surrounding indifference, the importance of improvements of any kind is severely felt—and the real ingenuity of agriculture is but little exercised. Now, over this condition of labor and society, we, in this country, enjoy an immense advantage. Whatever improvements are made here redound to the benefit of the whole, and grow out of the stern and insatiable demand of the whole for every means by which they can be added in their work. On this account we have already outstripped the best countries of Europe in some of our agricultural operations and in many important inventions. For instance: American reaping and mowing machines have been brought to a high state of perfection within the last ten years. They have already won a world-wide reputation. Their superiority is generally acknowledged and the credit of having for the first time made the principles applicable to such machinery practically useful, undoubtedly belongs to our ingenious mechanics.

Some years ago the American machines were brought to trial at the exhibition in Paris, in competition with the world; and, after long and careful experiment, were found to have hardly a rival in the manufacture of other nations. The enthusiasm of the spectators was unbounded. "All the laurels," says the report of a French agricultural journal, "we are free to confess, have been won by the Americans; and this achievement cannot be looked upon with indifference, as it plainly foreshadows the destiny of the new world." I can give you another illustration of the superiority of that general and unlimited intellectual activity which is found in America, applied to agriculture. The introduction of merino sheep took place in France and America about the same time. In France the famous Rombouillet flock was reared with all the care possible, and regardless of expense. It offered to the farmers of the empire the strongest inducements to improve their flocks; and the offer was rejected. In America the

first importations sank into neglect and disrepute. They languished in the hands of those whose wealth was greater than their agricultural skill. And not until the strife for their improvement commenced among farmers themselves here, were they brought to perfection. And so rapidly was the work done that when the French merino and American merino were brought into competition at the world's fair, the American merino took the lead in every valuable point—shape of carcase, weight and quality of fleece, and general condition. While the wealth of France had endeavored in vain to bring about any really valuable improvement, and the farmers of France had looked idly on, the intelligent yeomanry of Vermont had taken the matter up, and with a skill and foresight equaled only by the best breeders in England they had created the best fine-wooled sheep in the world. No more interesting sight of the kind was ever witnessed than the triumph of George Campbell, an intelligent and unobtrusive Vermont farmer, modestly presenting the sheep of his own State in successful competition with animals reared without accurate knowledge of their wants, and shown in the ornamented pens of the Emperor of France. It is this popular necessity, this level, this indiscriminate rivalry and effort, which shapes and moulds the character of our agricultural progress in this country. Agricultural schools and colleges spring up. Agricultural societies and clubs exist everywhere—the least conspicuous being often the most efficient and useful. In a town exhibition in this State I found a little herd of shorthorns belonging to a working farmer, who had reached almost the highest rank as a breeder. And I know many most valuable herds in the hands of just such men in other States. At one time every farmer in Vermont studied how he might produce the best flock of merinos. Our villages are now full of rival fruit-growers, on a large scale and a small one. The owners of small farms are in the market as purchasers of pure-bred cattle of every description. The questions of crops and manures and animals are discussed everywhere. Book farming is appealed to; the aid of science is invoked; agricultural lecture rooms are thronged. I have seen the entire business of a thriving town in New Hampshire suspended for a day, and the village church thronged in midwinter to listen to a long disquisition on the practice of agriculture. Good implements of husbandry are in demand—not heavy machines alone, but hoes, and spades, and shovels, and forks, which are so nicely balanced and so gracefully constructed as to work easily in the hands of the popular

sovereign who is to use them. And the effort is everywhere to make agriculture the work of the intelligent mind as well as the strong and skillful hand. And this is agricultural progress here. In addition to all this there is a growing determination in the minds of our people to rely as much as possible upon their own resources and their own markets, and there is also a growing opportunity. The American market, local and distant, is now the great market for our products. And while the east draws her staples from the west, she finds within her own borders manufacturing towns starting up on every stream, and furnishing markets for the crops of the surrounding country. Devoted to this great internal traffic, our lines of railway multiply almost beyond computation; to be conducted ere long, I trust, in the interest of a great producing and consuming people; carrying food to the hungry and clothing to the naked, at rates which will no longer aggravate the sufferings which they should relieve. Within the last thirty years, and perhaps less, this whole business of transportation has changed and given a new stimulus to agriculture. The great water courses are not the only occupied highways now. Every State, every county, almost every farm has its railroad communication. Every hill pasture, the crops of every valley are brought within a few hours of market. The cattle which to-day grazed upon the rich pastures of the west, before to-morrow's sun, are far on their way to feed the teeming population of New York and the eastern cities. The transit of a thousand miles to-day is attended with less labor and annoyance, than the farmer of half a century ago underwent in carrying his grain to market, over fifty miles of rough and muddy road. Meanwhile the relations between the farms and markets of different sections of the country have become so adjusted, that no farmer can raise a crop in vain.

The estimates of the actual increase of our agricultural products, in connection with the efforts to which I have alluded, are extremely interesting. The summary of the agriculture of the United States in 1840 shows that we produced at that time 84,823,272 bushels of wheat, 123,071,341 bushels of oats, 377,531,875 bushels of corn, 35,802,114 pounds of wool, and that the total value of the principal crops of that year was $336,000,000 considered at the time an enormous sum. In 1862, however, only twenty-two years later, the yield of twenty-one loyal states alone exceeded this estimate, the wool clip having increased to nearly 80,000,000 pounds (it is now 120,000,000 pounds), and the value of the crops of that year is estimated to be

worth $736,586,326—all this exclusive of the vast amounts of cotton, rice, sugar and tobacco which were raised in the Southern States, and which entered into the calculation of 1840. And if we examine the cotton crop of the same periods, we shall find that it had increased from 790,479,275 pounds, in 1840 to 2,000,000,000 pounds, or thereabouts, in 1860, just previous to the breaking out of the war. Guided by these figures, what have we a right to estimate for the twenty years following? In the twenty-one States upon whose crops the computation of the crops of 1862 has been made, we may estimate the grain crop of 1880 to be worth $1,500,000,000—leaving uncounted the hay crop and the root, fruit and garden crops, which are constantly increasing. And I have no doubt the cotton crop will be more than doubled in the hands of the small farmers of the south. The aggregate value of the crops of 1868 is estimated at $1,811,668,915. The corn crop is valued at $569,512,480, the wheat crop at $319,189,710, the hay crop at $351,941,930, and the cotton crop at $225,000,000. While a general survey of our increasing agriculture furnishes us with this encouraging view, we can also derive great satisfaction from the improvements which are going on in the more precise and limited branches of farming. We who live in the nothern section of our country have found that the most careful cultivation is especially necessary and important. The wholesale farming of the west and south does not apply to our harder climate and narrower valleys. There is no section in which the highest skill is so necessary, and none in which the farmer is so much stimulated to exercise all his best faculties. As I have endeavored to demonstrate, we have already done much, and we may do still more. And when we look around us and see that the minds of our people are turned with renewed energy to the land, I think we may anticipate an era in which intelligence and capital will be devoted to the work of advancing upon a new career of agricultural enterprise and prosperity, far more satisfactory than anything that has yet been accomplished. The way is now fairly open for us to step beyond mere tradition, experimental, spontaneous agriculture, into a system whose laws are as definite as the mind of man can make them. And with a department of agriculture organized, as I trust it may be ere long, as a branch of the general government, upon a scale equal to the demands of a country like ours; with schools and colleges rising upon every hand; with an agricultural journalism untiring in its energy and conducted with the best intelligence—the enterprising landowner may expect

to obtain all the information required to bring his estate economically into a condition of profit and beauty, so that the owning of land may no longer be a burthen. While we witness with pleasure the increasing air of thrift manifested in the farmhouse and fields of our people, we are always gratified by the drafts which the merchant and manufacturer are ready to make upon their incomes for the improvements of their farms. And it is important that this money should be invested to some profitable account, and not to please the taste alone as an expensive luxury.

I have stated that we are evidently advancing into a new era of agriculture, in which the intelligence and ingenuity of man are to be taxed in their efforts to bring this art to a systematic and well-directed basis. The difficulties which may be overcome by scientific investigation are, however, not the only ones which beset our path, and which must be removed before we can reach any great degree of perfection and prosperity. There are in our modes of farming in America, certain practical defects which must be overcome in a practical way. In everything which relates to economy of labor and means we are lamentably deficient. We use our forces and apply our means in too wasteful a manner to secure for ourselves a constant and liberal reward. I do not allude to the ordinary wastes of the farm, so called, such as the loss of manure by exposure to the weather, the neglect to use all articles which may be converted into fodder, &c. But I refer to the—1. Misdirection of labor; both hand and machine labor; 2. To the expensive modes of preparing and using manures; 3. To the injudicious selection and manipulation of soils; 4. To bad choice and bad feeding of animals; 5. To the too prevailing indifference with regard to the crops raised on the farm, whether fruit, roots, grass or grain. I suppose it is hardly necessary for me to argue here, that it is special farming which has become most satisfactory, interesting and profitable. Mixed farming may be necessary to a certain extent everywhere, for the feeding of the family, and the supply of certain wants in a local market. But it is devotion to special crops in the Northern States—crops adapted to each locality—from which the farmer now draws his largest revenues. The economical production of milk, near our large cities; the growing of tobacco in the valley of the Connecticut river; the cultivation of cranberries on Cape Cod; of garden vegetables in the open air and under glass, in all the populous Northeastern states; of potatoes in Maine; of fruits, large and small, in New York and New Jersey; of the onion

crop in many localities, have become sure and reliable modes of obtaining an ample income from the land. Seldom have well-ordered efforts been made in these directions in vain. The earth and the animal kingdom are sure to respond favorably when the appeal is made to them in proper form. And so, the careful breeder of cattle, horses and sheep, the skillful cultivator of onions, or carrots or tobacco, the accurate manager of hot-beds or green-houses, all prosper. And under this rule may and will be brought grass and grain, when the new lands shall have become old and their original fertility shall have been lost. The statement which I made two years ago, at the meeting of the New England Agricultural Society in Providence, that a farmer in Massachusetts has made a fortune of nearly $250,000, in thirty years, on thirty-five acres of land, was made in reference to one instance of special farming which had come under my own observation. The fortunate cultivator is a resident of Middlesex county, Massachusetts ; his farming is as systematic as the management of a cotton mill; his crops, standing in alternate rows, as uniform as the colors woven by a Jacquard loom, come forward so as to keep the soil in constant occupation, and his skill with glass turns January into July. New York and Boston are his markets. And he is not alone in his prosperity, nor in his luxuriant crops of lettuce, cucumbers, spinach and other esculents, which he produces almost every month in the year, under the heats and frosts of a northern latitude.

FARM LABOR AND MACHINERY.

Now, in order to make this prosperity more general than it now is, we need a more accurate direction of farm labor than we now have, and improved and additional farm machinery. The application of skilled labor to the land is becoming an imperative necessity. The time is passing away when the man who is fit for nothing else is fit for the farm. And in no branch of business is it more important that two men should not be directed to do what can just as well be done by one. The proper distribution of skilled and competent labor is a part of the necessary management of every good farm and the effort of every good farmer. And this labor should be aided in every way by the best machinery. Urging upon our mechanics the necessity of constructing strong, reliable, well-built machinery, with the best materials of metal and wood, without which they will disappoint the farmer and injure their own reputation, I would remind them that agriculture still demands the application of the best

machinery to many of its nicest operations. Not only are mowing machines and horse-rakes, and horse-forks and rock-lifters and stump-pullers required, but machines which will pulverize the soil, clean it of roots and weeds, and perform expeditiously and thoroughly what is now done in a tedious, expensive and rude manner by such unsatisfactory implements as the plow and grubber. We need a better implement for turning the sod than the plow—an implement more easily handled and more effective. We need a seed-sower which will be more accurate and economical in the distribution of seed, and which will cover the seed with firmness and equality, so that germination will be more uniform, and the effects of heat and cold and drought and water on the seed will be less extreme and imperious. We need implements for weeding and thinning crops, especially roots and many garden vegetables, without the use of slow and toilsome and expensive hand labor. We want to substitute perpendicular for horizontal labor in our onion fields. And I have no doubt that we shall ultimately be enabled to reduce materially the cost of labor on our most expensive crops by the use of skill and machinery, and to make easy and tolerable that which is now arduous and repulsive. Is it too much to expect that the progress of practical agriculture will lead to this ere long?

Preparation and Use of Manures.

The expense attending the fertilization of the soil is a burdensome obstacle in the way of profitable agriculture. It is not only the cost of producing the manure which we are to consider—for that is often covered by the profit, either in meat or milk or labor of the animal fed—but it is the amount of labor involved in placing the manure in the soil. Artificial fertilizers are, to a certain extent, an expedient for all this. But we have not yet found a substitute for barnyard manure in the production of our largest and most valuable crops. How to use this economically, then, is the important question. Reduce the labor upon it to the lowest possible point—this is the first requisite. Pass it from the barnyard or cellar to the crop it is to nourish, in as small bulk as possible, thoroughly decomposed for some crops, and leaving it to decompose in the soil for others. Avoid large masses of compost materials. Muck is undoubtedly useful in some soils, and in a certain amount, but never, as I believe, beyond the limit of a mere absorbent, when mixed with barnyard manure. Beyond that point it adds nothing but bulk, and weight, and

expense. It cannot be thrown out of the bog, and carted into the barn cellars and out again, without a considerable outlay of labor and money. Expend no more of these on any compost than is absolutely necessary. Rely upon it, the action of unadulterated and undiluted manure on the soil is not to be lost sight of. Choose for composting that material in which your soil is deficient—muck for light lands and sand for clays—and have faith in the fertilizing salts of the manure, and in their immediate and economical application, and generally in composting with the soil to which the manure is applied. Remember that manure should be placed within the soil, so as to avoid evaporation, and prevent the escape of gases, and at such a depth as not to be beyond the immediate influence of the atmosphere, without which decomposition will not take place; that decomposition which, Voelcker has taught us, increases the value of manure, in soluble salts, in greater proportion than it reduces its weight and volume. Use all the barn-yard manure you can get; apply as little labor to it as possible; and be not led into increasing its bulk by an unnecessary admixture of composting materials. The use of commercial fertilizers, of every description, hardly comes within the scope of my subject. Every man must judge for himself which of them he is to use, and how to apply them. Valuable as they are to the cultivator, they constitute but a small proportion of the aggregate amount of fertilizers used in this country; and their economical application by labor is not so much a question with the farmer, as the permanent benefit to be derived from their use, and the most reliable means by which they can be furnished to the consumer in an unadulterated form. I have said it is not profitable to transport muck and sand in too large quantities, or too great a distance on the farm; I think it is not safe to purchase them by the barrel at too high a price in the market.

Selection and Management of Soils.

Great care should be exercised in the selection of soils for special crops, and in the choice of lands which are to be cleared, and especially of those which are to be drained. Every farmer is expected to know that he cannot raise mangold on gravel, or Swedes in a clay pit; but all men do not exercise this knowledge if they have it. A wise man plows his clay lands in the fall; and stirs not his light and leachy lands until spring. But all are not wise. It indicates unflinching energy and courage to clear the stumps and boulders from a

somewhat inaccessible piece of land, while a comparatively smooth and convenient and cultivated acre near by is left unattended to and half tilled; but it does not indicate much judgment. And all men are not judicious. I have no doubt more money is spent annually in draining peat bogs and cold muck swamps than would be required to thorough-drain into warmth and fertility all the valuable claybeds adjoining. I have known farmers ruined by draining bogs; but I never knew one to fail in finding his profits from a well tilled, thoroughly drained clay field. We must learn this practical lesson, or our progress into agricultural system and success will be painfully impeded.

CHOICE AND FEEDING OF ANIMALS.

It is of the highest importance to know how to select animals adapted to the locality in which they are to be reared and fed. We must recognize the law, that the most profitable animals are those which will make the largest returns for the amount of food consumed. Time was when a farmer was judged of by the size of his cattle; the largest oxen being considered an index of the wisest owner; but form, and thrift, and quality, and fitness are now beginning to be deemed of greater value, even where attended by a reduction of size. Every attempt to force an animal on land unfitted for it, every attempt to compel a large, heavy-carcased cow to get a living on pastures adapted only to a smaller one, must end in failure. Our cattle should find abundant nourishment on our hills and in our stalls, and should be selected with reference to this, rather than to that magnitude of proportion which gratifies the taste, regardless of the purse. The constitution of every animal should, moreover, be adapted to the climate in which he is to live. The cattle of Kentucky differ materially from the cattle of New England; and any effort to transplant the animal organization created under a mild sky and on blue-grass pastures into a hard climate and short grass, is a violation of nature, for which the farmer will in the end suffer, and which will be remedied only by an accommodation to nature after a few generations. The dairy being the great object of cattle feeding in the northern States especially, a hardy, compact, thrifty cow, easily kept during the winter without grain, and satisfied with pastures not over-luxuriant in summer, is especially desirable, both for dairy purposes and for beef when the work of the dairy is over. Such an animal will thrive in summer, will hold her own on common food

in winter, and will fatten rapidly when fed for that purpose. There is more profit in feeding two medium-sized animals, on a pasture fitted for them only, than there is in half-feeding a large one on the same pasture. In all feeding, other than grazing, we should also feed for a definite object. Young animals intended for the dairy should be fed with reference to that alone, and in such a way as not to injure the lacteal system. Their food should be oatmeal, Swedish turnips and rowen hay. And through life they should be fed upon such articles, and not upon the oleaginous grains, such as Indian corn, and cotton seeds, and oil-cake. Young animals intended for beef should be furnished with an abundance of fat-producing food from the start, and in this way will their nutritive functions be directed steadily to this object. Feed them for a definite purpose. In this way alone can the true economy of feeding be arrived at. The waste of hay, roots and grain in this country is enormous, solely on account of an injudicious selection of animals to be fed. We know, or ought to know, that a hundred pounds of food fed to one animal is worth much more than a hundred pounds of food fed to another animal; but we do not always profit by our knowledge. The producer of milk, for instance, may make thirty per cent more milk from his store of hay, roots and grain, fed to one class of cows then he can when it is fed to another. And we shall never feed as profitably as we may, until we have overcome our prejudices, and select our cattle with special reference to a given object, and not to gratify an idle fancy. The neglect of this rule is one of the most formidable obstacles now in the way of successful farming.

CROPS.

There is still too great indifference to the crops raised on our farms, and to their location and modes of cultivation. The wholesale orcharding of our ancestors must be abandoned. Fruit culture has become more a matter of horticulture than agriculture. The growing of apples should be confined to lands unfitted for other purposes both by quality and location—such as ledgy hillsides, abounding in mineral deposits and deficient in clay and vegetable mould. No man can afford to have his fertile fields lying near his farm buildings occupied by orchards. His manure is easily transported thither, and his annual crops should grow as near home as possible; for from these comes his constant profit. What I say of orcharding does not apply of course to the smaller fruits which come within the list of annual crops, and commence their returns shortly after planting. But

twenty years must past away before an orchard begins to yield fruit, and that is a long time to wait for a dividend from any investment. The value of root crops is, I regret to say, still but little understood in this country. I discuss the turnip crop with many men, and I find they have not yet got beyond the English flat turnip; a root hardly worth calling a field crop. The great root of modern agriculture for cattle feeding, the Swedish turnip, the purple-top king of the Swedes, is unknown to them still; the cheapest root that can be raised; sown on light lands, the middle of June, and treated mainly with super-phosphate of bones; and the best root to feed store cattle and young cattle, and, for horses, vastly superior to the carrot. You can raise nine times as much food in weight of Swedes on an acre as you can of hay, with the same condition of land, and each pound of this hay finds its equivalent, in nutritive properties, in three pounds of turnips. You can judge of their value as determined by tests; and you should remember that an animal is almost always in better condition in the spring, when supplied with roots during the winter, than without them. What I have said of turnips as a most valuable crop for the farmer who is wintering cattle, horses and sheep, will apply to mangolds as a root for a winter dairy. Carrots I have abandoned as too expensive and troublesome in cultivation, as unfit for beef or milk, and less valuable, by far, as a food for horses than the Swedish turnip. I have no doubt that the business of feeding cattle and sheep could be doubled in profit by devotion to the various root crops, and that the great mortality which often prevails among the latter would be avoided by a liberal use of the turnip alone. To select the farm crops judiciously; to know how much corn to plant, and small grain to raise, as a necessary part of the farm economy, with markets filled with these articles; to ascertain what green crops are best for the soiling of cattle, whether corn fodder, which I think is the poorest, or orchard-grass, or millet, which I think is by far the best, are questions still open for every practical farmer to solve for his own benefit and that of his profession. I have hastily presented to your minds the character of agricultural progress in America, and the obstacles which lie in its way, and which by science and practice we are endeavoring to remove. In doing this here, I fear that I should not be doing justice to the agricultural enterprise of the State of New York, did I neglect to call your attention to what she has done and is doing to advance and perfect the great art of agriculture. Does any one doubt the profits of farming? Let him traverse the thrifty

farms which lie all along your valleys, and let the prosperous farmers, old and young, remove his doubts as they may. Does any one question the useful effects of agricultural societies? Let the honorable record of the New York State Society, its careful investigations into every branch of cultivation, and its examinations into and encouragement of the best farm machinery, furnish the reply. Does any one disbelieve in agricultural schools? Let him wait until the array of talent and learning called around Cornell University can solve the problem. Does any one still doubt whether intelligence, skill, taste and capital can be profitably employed on the farm? Let him study the example so nobly set by the prosperous merchants of New York, who have retired from the excitements of the counting room and the exchange, not simply to embellish a landscape by wasteful outlay, but to conduct a large and profitable practical agriculture. In their endeavors to improve the cattle of this State they have produced the finest breeds in the land, and they have also demonstrated the profitable nature of such enterprise. They have not only possessed themselves of extensive tracts of land, but they have devoted their acres to remunerative cultivation. They are a living rebuke to that superficial and trifling view of agriculture which consigns every tasteful and educated farmer to extravagance or poverty, and sets forth the failures of the ignorant as the hard fortune to which every man is destined who would apply intelligence and capital to agriculture. Their practical farming is an example which all might well follow. But not this alone. They have given to the rural life of the State of New York a character not surpassed in this or in any other country. Whatever merit may be accorded to others, it will be remembered of them that they devoted themselves to the development of your best resources, and to the perpetuation of those characteristics which have been the pride and glory of every great people. They have taught us to love the land as our fathers loved it, our wise men and counselors of old; to love it as the people of ancient days loved it, whose great men enjoyed their favorite retreats, and listened many a returning spring to the nightingales that tenanted the dark ivy and greeted the Narcissus, ancient coronal of mighty goddesses, as it burst in beauty under the dews of heaven. They have taught us what a rural life may be, and what that progressive farming is which is within the reach of every intelligent, well educated and industrious American citizen.

THE WOOL INDUSTRY OF THE UNITED STATES.

AN ADDRESS DELIVERED AT THE EXHIBITION OF THE AMERICAN INSTITUTE, OCTOBER 5TH, 1869.

BY ERASTUS B. BIGELOW, ESQ.

May I ask your attention for a few minutes, ladies and gentlemen, while I say a word in relation to a single department of this great exposition ? It is by the appointment and request of those who have the direction here, that I shall speak to you on the subject of wool and its manufactures, Among the numerous aud varied products of art and industry which this occasion has brought together, you must have noticed that woolen fabrics hold a conspicuous place. The National Association of Wool Manufacturers, now about five years old, had already resolved on a special exhibition of their products ; when, through the generous courtesy of the American Institute, a a place was given them here. That old, honored, and useful institution desires, I am confident, no better proof that its kindness is fully appreciated, than that which our manufacturers have given in filling their allotted space with so many fine products of skillful industry.

Though the annual fairs of the Institute have long been celebrated, it may be doubted whether on any previous occasion there has been so rich and varied a display. As regards that part of it to which I now call your attention, I think no one can pass through the building and not discover that in the number and variety of its contributions the woolen department far exceeds any other of the industrial interests here represented. This pre-eminence is due to the fact that these woolen contributions are the result of associated and systematic effort. Even this collection, large and full as it seems, gives but a partial idea of the wool manufacture in our country. Had all the other arts and industries which are to be seen on this spacious floor labored to bring out their strength as successfully as we have labored, the Institute would have needed numerous rinks as vast as this.

This exhibition of American woolens is the first instance of any attempt, in our country, to bring before the public eye, in one great collection, the characteristic products of a single industry. We can, I trust, honestly say that it is prompted by a higher motive than that of ambitious display. In no other way can the progress, the extent, and the value of such an industry be so effectually shown. No statements or statistics can be so impressive and convincing as the visible evidence which is furnished by an exhibition like that now before you. It is the next best thing to actually visiting the manufactories from which these fabrics come. Could you pass through the great establishments so honorably represented here, and look on their busy wheels and cards, and spindles, and looms—their myriads of thrifty, happy working men and women, the huge masses of raw material which they work up, and the countless car-loads of finished fabrics which daily leave the mills, you would need no argument to assure you that the woolen industry of the country is second to no other, whether individually or nationally considered.

The annual value of our wool manufactures, and of those manufactures in which wool is a component part, is not less than $175,000,000. Of these goods more than four-fifths are made from American wools. The coarse carpet-wools, which are not grown here at all, the worsted combing wools, and the fine clothing wools, which are grown by us only in limited quantities, go to make up the rest.

In relation to the articles now brought out under the direction of the National Association, it is only proper to state that none of them were made specially for this occasion, or appear as candidates for prize awards. They are the usual products of the mills, such as are got up for the general market, and they are here, not for individual gain or glorification, but rather to show the quality and the variety of our wool fabrics, and the extent to which they supply, or can supply, the wants of the American people. The fine quality and the beautiful finish of many articles in this collection cannot fail to arrest attention. Yet the real significance of the display is to be seen, not so much in this as in the wide range and diversified character of the fabrics, in their soundness and their fitness for the uses intended, and in the low prices at which they can be furnished. For instance, in no market of the world can better cassimeres be found than some of those which are here exhibited.

These meet the demands of one class in the community, while the wants of another and far more numerous class are met by cloths

equally excellent, because equally adapted to the use for which they are designed I have selected a particular case, but this remark has a general application.

This display of woolen fabrics is instructive, as showing the great advance which a comparatively short period has effected, in the diversification of our wool manufactures. Ten years ago, our manufacturers had attempted scarcely anything beyond common goods of the coarser kinds. Now they produce almost every variety of wool fabric in general use. Among those which are now successfully made here, but which are comparatively new as American productions, I may mention lastings, bunting, worsted reps and serges for furniture covering, worsted furniture damask, Italian cloths, worsted poplins, mohair poplins, mohair lustres, cashmeres, merinos, Astrachans, chinchilla cloakings, Scotch cassimeres, embroidered table-covers, Axminster carpets.

The annual consumption of woolen goods in the United States may be put in round numbers at $240,000,000. In 1868, for instance, we imported woolen goods as follows:

Cloths and cassimeres	$6,956,449
Shawls	1,559,999
Blankets	28,196
Carpets	2,766,291
Dress goods	15,196,233
Manufactures not specified	5,902,591
	$32,409,759

The above figures it must be remembered, represent the foreign valuation as expressed in gold. In comparing the value of woolen goods imported with the estimated value of our home productions, we must add to that valuation the customs duties, the premium on gold, and the profits of the importer. With these all on, the value of sales in first hands is fully double the amount of foreign valuation. If now to $175,000,000, the estimate of our domestic product, we add $64,819,518 for the sales of imported woolens in first hands, the result is $239,819,518. Thus it appears that our manufactures amount in value to nearly three quarters of the whole.

Nothwithstanding the unquestionable and the generally acknowledged excellence of our wool manufactures—a fact which this exhibition fully demonstrates—those manufactures still suffer, more or less, in the market, from prejudices and prepossessions which are

alike ill-founded. A preference for fabrics of foreign origin has very naturally come down from the time, not very distant, when our domestic products were generally inferior. Of those who now habitually insist upon buying the foreign article, some are honestly ignorant. They are not aware of any improvement in American manufactures. With others, it is the merest aping of a senseless fashion. But the delusion could not be long kept up, were it not for the interest of the dealer to sustain it. It is easy for him to make a larger profit on the imported article, from the fact that its probable cost is not so generally known. In many instances the tempation is so strong that truth, honesty, and patriotism make their appeal in vain. Not only are American productions systematically disparaged but, in a multitude of instances, these very productions are labeled as French, English, or German. The extent to which this imposition is carried is known only to those who are let into the secret. There are probably, very few of us who have not thus been taken in. And, what I am inclined to regret as the most melancholy thing of all, is the unquestioned fact that some of the manufacturers themselves have consented to the deed. I suppose the process by which such a bargain is consummated to be somewhat as follows : A manufacturer, after much toil and outlay, is prepared to introduce a fabric not before made here. He finds the market, however, fully supplied with the foreign article. Those who hold it give him no encouragement, for they know that the introduction of the domestic product must lessen their chance for high profits. Between him and the consumer (who must be reached somehow, or his enterprise fails) stands a class of men whose interest it is to sell foreign rather than domestic goods. The result is a compromise. Says the dealer to him, "I like your goods, but I can not sell them as American. Give them a foreign brand, confine the product of your mill to me, and I will take all that you produce." The poor manufacturer, seeing no alternative, closes the unhallowed bargain.

It will be strange if this exposition of our wool manufactures does nothing toward correcting those mistaken ideas in regard to the inferiority of American fabrics which are entertained by so many. It shows the great and respectable body of American manufacturers that there are those among them who have no need to sail under borrowed colors, and who, under any circumstances, would scorn the thought. It is a silent but eloquent rebuke to those dealers in such fabrics who, to promote their own selfish aims, are wont to decry

and deride everything that is homemade. And, finally, it appeals to the great class of consumers, and bids them be candid when they buy, even if they can not be patriotic.

It has been through a long series of difficulties and discouragements that our wool manufactures have attained to their present advanced condition. Not the least of these impediments has been a vacillating tariff. In this respect the policy of our goverment has been sometimes friendly, sometimes decidedly hostile. The tariff of 1846, which imposed upon wool a higher rate of duty than some of its manufactures paid, proved especially adverse. Under its baneful operation the growing of wool remained almost stationary, and many of the largest manufacturing companies became bankrupt.

From peculiar causes, not likely to occur again, there is considerable depression in the wool business at the present time. The scarcity of cotton which was caused by the war created an extraordinary demand for woolen fabrics, which came largely into use where cotton had been used before. The effect of this, and especially of the immense demand for army clothing, was greatly to stimulate the growing and manufacturing of wool, not only here at home, but in all those countries where these industries are pursued. Under these impulses the wool-manufacturing ability of the country was increased with a rapidity and to an extent wholly unknown before. Cotton mills were converted into woolen mills and new establishments sprang up as if by magic in many parts of the United States. And now we behold the natural—I think I may say the inevitable—result, namely, an amount of production which is largely ahead of the demand. Though the machinery in operation was no more than the imperative necessities of war required, it far exceeds the normal demand in time of peace.

The condition of our wool industry in 1868, as compared with the years 1850 and 1860, is shown by the following tabular statement:

ITEMS.	1850.	1860.	1868.
Pounds of wool grown	52,516,959	60,511,343	177,000,000
Value of wool imported	$1,681,691	$4,842,152	$3,915,262
Value of wool manufactures imported	17,151,509	37,937,190	32,409,759
Value of domestic wool manufactures	45,281,764	68,865,963	175,000,000

This statement shows conclusively that it is not by the influx of foreign goods that our market for wool and woolens is depressed, the value of imported woolens for 1868 being $5,500,000 less

than it was for 1860. Most evidently, the great cause of the present depression is excessive home production. In 1860, the annual value of our domestic wool manufactures was $68,865,963. In 1868, it had risen to $175,000,000, an increase in eight years of $106,134,037. It is a pregnant and important fact that our statistic returns show similar results in regard to the growth of wool during the period under consideration. With a production that has increased in eight years 150 per cent, while our population has advanced only thirty per cent, can we wonder that the market is depressed? The wonder, as it seems to me, is that the business is not utterly prostrate.

It has often been asserted that the depressed condition of the wool industry is due to the present high tariff on wool and woolens. The facts and figures just adduced show how baseless this allegation is. That beneficent law, so far from having an injurious effect on this great national interest, may rather be said to have saved it from destruction. I have already referred to the agency of the cotton famine in stimulating elsewhere the growing and the manufacture of wool. It led to over-production in other countries, as well as in our own. For several years past the stock of merino wools—those wools which chiefly compete with the American product—has been unprecedently large in the foreign market, and has sold at prices ruinously low. Had our own wool-growers not been defended against this outside surplus, by an increased duty, millions upon millions of their sheep must have gone to the shambles, and their business would have been ruined. It would be a satisfaction to many, if those persons who ascribe to the tariff the present low prices of American wool, will just point out how those prices would have been *raised* by the introduction of that foreign surplus at a lower rate of duty.

So, too, of manufactures. When the war ended, the goverment ceased to buy, and, having on its hands a vast accumulation of army clothing, threw it on the market at rates that were extremely low. Since that time, also, the surplus of foreign manufactures, offered at low prices, has helped to weigh down our market. In this crisis; what but the increased duty on foreign goods has saved our manufacturers from a general overthrow? Will not some one show us in what way the reduction of those duties, and the flood of foreign goods which would inevitably have deluged our over-stocked market, could have helped the American producer? Until questions like these are satisfactorily answered by the opponent of the law, his positions and assertions must be regarded as of small account.

Our wool industry being depressed by over-production, its restoration to the normal relations of demand and supply can alone bring relief. In some classes of the wool manufacture, where the excess has been less marked, this desirable change has already come, and these branches are again reasonably prosperous. Unless some hasty and disastrous alteration is made in our tariff laws, time and progress can not fail to bring the same relief to all. The existing law has done good service in protecting the American producer against excessive and ruinous importations, at a time when the danger of such importation was great; and there is good reason to believe that it is well adapted to insure the continued development and the enduring prosperity of American industry. At the least, let us give it a fair trial. The unusual condition of the woolen interest and of the national currency have interfered with its legitimate working, and make it somewhat difficult to estimate its eligibility as a permanent policy. Not until the business and the monetary interests of the country rest once more upon a natural basis, shall we be fully prepared to decide the point. The consumer, certainly, has some reason to be satisfied with its results; for the prices of many woolen goods (reckoned in gold) are actually less than they were before the war.

It was, as you are aware, at a conference of leading manufacturers and growers of wool from all parts of the United States, and after full consideration and discussion, that the principle which underlies our present tariff on wools and woolens was unanimously adopted. It is, in fact, only a clearer and stronger expression of the idea on which the (so-called) "Morrill Tariff" of 1861 was partly based. It aims to give equal protection to him who raises and him who works up the raw material. It tends directly to reconcile great interests, which had been falsely regarded as antagonistic. And, best of all, by substituting united endeavor for hostile action, and a system well considered for capricious ignorance, it gives a ground of stability, and a reason to hope for it, which our tariff legislation has long and greatly needed. While it protects the wool-grower, it simply places the manufacturer where he would be were his raw material free. The duties on wool are practically neutralized by a specific duty on woolens, which, for purposes of revenue and protection, are also taxed with an *ad valorem* rate. Another and very important feature of the present tariff is its new, simple, and entirely practical classification of wools.

Our wool manufacturers have been subjected to much severe and

unjust remark, under the mistaken notion that the whole amount of the duty on woolen fabrics operates as protection for them. The true state of the case is very different, and ought to be known. In the first place, the *specific* duty, so far as that goes, gives them no protection. It is compensatory merely, balancing the duty which they pay on their wool. The *ad valorem* rate, also, is neutralized, in part by the duties on other materials used in manufacturing processes, and by local taxes, from which their foreign rivals are exempt. The actual protection which the tariff gives to the wool manufacturer (if we except a few goods of the finer descriptions) is less than thirty per cent, a rate which cannot be regarded as excessive or unreasonable.

Considered as an element of national prosperity, the *growing* of wool is no less essential than its manufacture. Perhaps it should be regarded as even more important, in view of the food which is thus supplied, and of the support which is given to agriculture. However this may be, it is certain that these two great industries are mutually related, and bound to one another by common interests. Neither of them can long prosper unless the other prospers also. Let our manufactures come to an end, and the grower, unable to compete with foreign wool-raisers, would have no market for his clip. The manufacturer, on the other hand, needs constantly a reliable supply of home-grown wool, not only to regulate the cost of his raw material, but also to insure soundness and uniformity in his fabrics.

Impartial justice and sound policy alike require that both of these important departments of the nation's industry should be kept, so far as legislation can thus keep them, on a footing of equality, and in such a position as will leave to their foreign rivals no advantage over them.

On the great questions of protection and free trade, it may be expected that I should say something on an occasion like this, and at a time when they are receiving more than usual attention in the discussions and the journals of the day. I believe that there can be no greater mistake than to suppose that the principles of either free trade or protection are universally applicable. The policy which would benefit one country might be highly injurious to another. Even in the same country, the condition of things may so change, in course of time, as to justify and require the abandonment of a system which had been highly beneficial. Eminently, therefore, may the tariff question be regarded as a practical question. All discussion

of it on purely theoretic grounds, and apart from facts, is worse than idle, for it tends to mislead.

Production being the source, and the only source, of national wealth, can it be doubted that our tariff legislation should aim at imparting to the labor of the country the highest degree of productive efficiency? For this we need a largely diversified industry, giving employment to persons of every class and condition, and calling into use all the additional power that machinery and science can bring to its aid. To adopt and enforce the system of those who are now clamoring for free trade, would be the very reverse of this. It would result in a tame surrender to other nations of all that we have accomplished in the way of manufacturing industry and improvement, and would remand us to those ruder descriptions of labor in which mechanical skill and science have, comparatively, but a limited application.

We ask protection for American manufactures, not certainly because our countrymen are less capable than their European rivals; for in intelligence, ingenuity, and aptness to learn they have no superiors. It is not because our natural advantages are less, nor from inability to acquire the requisite skill; for we have carried some manufactures to a perfection nowhere else attained. There are however, certain conditions which effect, directly or indirectly, the cost of production, in respect to which the other manufacturing nations have a decided advantage over us. I refer to the rate of wages paid for labor, the rates of local taxation, and the rates of interest on capital. That these are things beyond the control of our manufacturers, no one will deny. That the necessity of paying, in all these respects, much higher rates than their rivals have to pay, puts them at a serious disadvantage, seems equally certain. That there is one way, and only one, by which this damaging disparity can be counterbalanced, I think you will also allow to be perfectly clear.

Let us see now how this case stands. Mr. David A. Wells, Special Commissioner of Revenue, who has investigated this subject at home and abroad, thus states the difference between the rates of wages paid in the United States, and the rates which obtain in several other countries (gold being taken as the standard in all cases).

In the cotton manufacture, the excess of wages paid in the United States over the wages paid in great Britain is 27 7-10 per cent; over Belgium, the excess is forty-eight per cent.

In the wool manufacture the excess over Great Britain is, in woolen mills, twenty-five per cent; in carpet and worsted mills, fifty-eight per cent. Over France, Belgium, Prussia, and Austria, the average excess is 100 per cent.

In iron founderies and machinery building, the excess over British wages is fifty-eight per cent.

In the manufacture of iron, the average weekly wages paid to puddlers (in gold) are $16.24 in the United States; $8.75 in England; $8 in France; $6 in Belgium; $1.39 in Russia.

In reference to the inequality that exists in the rates of local taxation, the same statistician thus reports:

"If we select, as an example, the cotton manufacture in Great Britain and the United States respectively, we find that in the former country the incidence of all local or other direct taxation extends only to the rental value of the buildings for the reception of machinery or the promotion of other details of the business; and does not in any way, regard the value of the machinery which may be placed in such buildings, or the capital employed in its workings.

"On the other hand, in the United States, the incidence of local taxation falls on everything connected with the business of cotton manufacture that is accessible, namely, buildings, land, and machinery; and is, moreover, not unfrequently duplicated in the following manner: Thus, factories are often built in this country under acts of incorporation in one State, while the stock is held or owned chiefly in other States. The municipality in which the factory is located taxes the buildings and machinery, and collects the tax of the corporation; the municipality, on the other hand, in which the stockholder resides, taxes the stock to him at its market value as personal property, and leaving the owner no remedy. In one instance (not an exceptional one) brought to the notice of the Commissioner, the aggregate of the local taxes imposed on a particular corporation in 1866 amounted to 4 9-10 per cent upon the capital invested, and in 1868 to over four per cent.

"But, vicious as this system is upon its face, its effect, especially in a national point of view, cannot be realized until we take into consideration the fact that the capital required in the United States to build a cotton-mill is about double the amount required for a similar purpose in Great Britain. Four per cent, therefore, on the capital of a cotton-mill in the United States represents eight per cent on

the same productive power in Great Britain, or a rate which is almost double the average rate of interest in the latter country."

The rate of interest on capital in the United States is, on an average, double its rate in England and in the other manufacturing countries of Europe. Capital is the basis of all business; and nowhere is it more essential to success than in the creation and conduct of manufacturing establishments. When it costs us twice as much as it costs our foreign competitors, we set out at a disadvantage of 100 per cent.

But for these inequalities of condition, our manufacturers could enter the race of competition with little fear of being distanced by any foreign rival. It is mainly upon this ground that they need and ask for protective duties. They seek no monopoly—no exclusive privilege. Give them an even chance in the game, and they will take care of themselves. Not until the cost of labor, taxation, and capital, through a gradual approximation, or by some great alteration here or there, shall have become nearly the same in Europe and America, will it be safe to abandon the present policy.

In view of such facts, you will readily perceive the mistake of those who adduce the rates of duties in other countries as examples and guides for us. The conditions of wages, taxation, and capital in the manufacturing nations of the European continent (Russia excepted) are so nearly alike that high duties, as between themselves, would be inoperative. Under such duties their international trade would cease. In France, Belgium, Austria, and Prussia the cost of manufacturing the leading articles is so nearly uniform that a duty of ten per cent protects them against each other as effectually as our higher rates defend us against them. The same, in effect, may be said of the Anglo-French Treaty, so loudly vaunted as a great step in the progress of liberal ideas. It can be proved that French producers under that arrangement receive more protection against British industry than is afforded by our tariff to American manufacturers, in their sharp competition with France and England.

So long as our local taxation shall depend on the will and action of the several States; so long as the rates of wages and of interest in our country are kept up by the abundance of land and the demand for labor, neither skill nor assiduity on the part of our producers can remove the cause of that disparity which places them at so great disadvantage. The remedy, the only remedy, is in the hands of our national government. With that power it rests to say whether, in

this great question of public and economic policy, their own people or foreigners shall be first considered. Let it be remembered, however, that equality is all we ask.

Congress has, we think, wisely entered on a protective system. To give it a fair trial, we need only confidence in its stability. A changing and uncertain legislation disheartens the producer, and is a constant check on enterprise. The talk about free trade would be harmless enough, but for the doubts and the fears of possible change which it inevitably excites. Weighed by its real merits, seen in its true light, it seems hardly possible that such a scheme should find favor with the American people. Unfortunately, as our history shows, and as we witness daily, other considerations, wholly irrelevant, are too often brought into the discussion of questions which are purely economic. What have party politics, what have benevolent efforts at reform in morals or manners, to do with measures which relate directly and solely to the industrial interests and policy of the nation?

There is, undoubtedly, something plausible in the general idea, something attractive in the mere name of free trade. It assumes the tone of cosmopolitan good will, and professes to aim at perpetual harmony among the nations. Regarded abstractly, its theories are charming, and promise us "a consummation devoutly to be wished." But the question is: Can we confide in the promise? There is a class of amiable enthusiasts who believe in the possibility, as we all believe in the desirableness, of universal peace. Would the nation but listen to them, she would forthwith raze every fortification, freight her war-ships with corn, and cotton, and melt her great guns into rails and plows. Why does she *not* listen? Why does she, why *must* she still fortify her harbors, replenish her arsenals, and keep up her navy? Because the arguments and exhortations of the peace society are founded on human nature not as it *is*, but as it *should* be. Because they strangely underrate the ever-present, though sometimes dormant power of selfishness and passion. When "the wolf shall dwell" peaceably "with the lamb"—when the nations shall all see eye to eye—the pleasing dream of the non-resistant may become a blessed reality.

Of kindred origin and character, as it seems to me, is the illusive notion of free trade—very fair in theory, but wholly unsatisfactory in practice. Ignoring, as it were, the great law of self-interest, and the lesson of all history, it goes upon the absurd assumption that henceforth

the different communities of mankind will be governed, in their intercourse of trade and business, by the golden rule. It is a system which will probably work well in the millennium, but it is decidedly premature in an age like ours. Unless these views are fallacious, it is just as much the duty of a nation to protect its own industry against the injurious effects of foreign competition as it is to provide the means of defending its soil and its homes against the aggressions of open war.

EVIDENCES OF PROGRESS AT THE EXHIBITION.

BY F. A. P. BARNARD, LL. D., PRESIDENT OF COLUMBIA COLLEGE, WHO WAS U. S. COMMISSIONER AT THE PARIS INTERNATIONAL EXPOSITION OF 1867.

Mr. President, and members of the American Institute.—In presence of the multitude of interesting objects gathered here together, many of them remarkable for their beauty, all of them, in their several ways, for their utility, it seems to me unnecessary to offer you any congratulations on the flourishing condition of your association, or on the encouraging success which has attended your laudable efforts to promote the interests of American industry. The scene in the midst of which we are assembled, speaks to this purpose a thousand times more impressively than I could do ; for, whichever way we turn, it addresses itself in endlessly varied forms of emphatic significance directly to the sight. At the same time, I have no purpose to attempt here any systematic survey of the history of industry, or to draw a parallel between our own and foreign countries, as to their relative degrees of industrial advancement. I make this statement in the outset, because I have noticed a public announcement that such would be my theme. The topic suggested would be one more suitable to a meeting limited to the members of your own institute, than to a popular gathering like that which I see before me. But I may remark in passing, that from the comparisons which I was enabled to make in the Universal Exposition of 1867, the position occupied by our country in the general industrial field, is one eminently honorable to the skill of our constructors, and to the enterprise of our manufacturers. There are certain classes of productions indeed, in which foreign artizans have attained a higher degree of excellence than our own ; for there are certain industries which are the growth of centuries in Europe, while with us they are only the creations of yesterday. But in regard to the vast multitude of objects which are most directly applicable to the every day uses of life, and which contribute in the highest degree to human comfort and enjoyment, the industry of our country may challenge comparison with that of

the most advanced nations of the world. In the construction of machinery, moreover, and especially in the invention of new and efficient machines for the saving of labor, and for the increase of productive power, it may be said, I believe, with justice, that our country is unsurpassed by any other, if it does not, in fact, stand superior to all rivalry. Though at the Exposition of 1867 the machinery of the United States was very inadequately represented, yet the ingenious novelties which it embraced attracted to it from visitors, from critics and from the jury, a degree of attention, and elicited an amount of admiration, far out of proportion to the limited space allotted to it, and to the number of objects which it embraced.

Dismissing then, for the present, this interesting theme, I resume the line of thought from which this momentary interruption has turned me aside. And I remark, in the first place, that your institution presents to my mind a striking and felicitous illustration of the importance and the power of the principle of associated effort. You exert, at this moment, constantly upon the mind of every individual throughout all this great metropolis and its surrounding dependent territory, who is engaged in any branch of industrial art, and who has the slightest ambition to excel in his vocation, an influence stimulating him to exertion, which is distinctly felt apart from all the ordinary motives which encourage or force men to labor. And an exceedingly important fact about this influence is, that it does not simply impel men to aim at accomplishing more, but urges them rather to attempt performing what they do accomplish better than before. The palpable evidence of this influence, as it respects both its existence and its power, is displayed in the magnificent collection of the triumphs of industrial art in the midst of which we are assembled. No force of coercion has been necessary to gather these together. They are the voluntary contributions of those by whom they have been created. But your institution has presented the attracting nucleus, around which they have clustered as naturally as the material particles suspended in a solution unite, under the influence of physical laws, to build up the symmetrical form of the crystal.

The power of associated effort has been recognized from the earliest dawn of civilization; but it is only within a period comparatively recent that, in the industrial or commercial world, it has been resorted to in a spirit truly liberal. The crafts and guilds of medieval Europe were organized with a view to the exclusive benefit of their members. They were, in general, close corporations, fettering the freedom of

industry by imposing oppressive conditions upon such as sought to engage in particular occupations, and watching with the extremest jealousy every threatened encroachment upon their proscriptive privileges. Such organizations continue to exist at the present time; less dictatorial, perhaps, than formerly, but still too frequently and unwarrantably interfering with the freedom of the individual. Divested of this objectionable feature, they are doubtless useful instrumentalities, not only as assuring to their members the benefits of mutual aid, but as enabling them to take counsel together, and to act unitedly for the common welfare.

But the associations of which your Institute is an example, are founded upon no such narrow or selfish principle, and aim to promote no objects more specially interesting to those who compose them than to other men. Your aim is to promote the welfare of the whole human race alike, by stimulating to the highest practicable degree, the productive power of industry. That in the forty years which have elapsed since its foundation, your Institute has accomplished much in this way is beyond a question, how much it would be difficult, among the multiplicity of cases conspiring to stimulate industrial activity, to estimate with exactness. But some idea of the usefulness of your labors may be gathered by considering the obvious modes in which your influence makes itself felt.

You have encouraged emulation by offering valuable recompenses in every branch of industry, whether mechanical, agricultural, manufacturing or artistic, to the most meritorious of the competitors at your periodical exhibitions. But it is by no means probable that the positive value of such rewards has been the principal stimulus which has urged the competitors to effort. The stamp of declared superiority publicly affixed by impartial and competent judges, to any article entered for such a competition, is a recompense of vastly greater, and of more really substantial value to the producer, than any merely pecuniary reward which the Institute would be able to bestow. It is so, because it gratifies a feeling which is always honorable, the ambition to excel; and it is so, moreover, because it commands for the object which is thus distinguished, and for its producer in like manner, the confidence of the public, and thus secures a demand for the one and a patronage for the other, which might otherwise have been much longer in coming. The effect of this consideration is stimulating constantly the effort to improve, to produce a better machine, a better fabric, a better fruit, a better vegetable,

and so on throughout the whole domain of industry, can hardly be computed.

But your periodical exhibitions are promotive of industrial progress, also, by bringing the results of the ingenuity of individuals to the critical examination of other minds; these starting from what has been already accomplished, are often able to detect imperfections or to suggest improvements which has escaped the original contriver. The possibility or probability of such new advances is greatly promoted by the opportunity which these exhibitions furnish, of comparing a variety of objects, processes, machines or fabrics designed to subserve the same end, but which reach the end by differing combinations. These will here be found side by side, and a judgment of their relative advantages may be formed under the most favorable circumstances. Out of such comparisons there can be no doubt that many valuable improvements originate, of which more than half the credit is justly due to this Institute.

It may further be said of these exhibitions, that they furnish to multitudes of people a vast fund of healthful entertainment, and of valuable instruction. Especially as schools for the young, they are of priceless value. To the youthful mind nothing is more exciting or exhilarating than to study the combinations of machinery, or to watch the transformations of matter in the processes of the arts. Here everything is novel, everything is wonderful; and the curiosity which is so lively a trait of the juvenile intellect finds an endless variety of material for its indulgence. There can, therefore, be no doubt that these exhibitions do much to bring out the latent genius which is slumbering in many a youthful mind, for the mechanic arts especially, and that some of the most distinguished of the inventors, or most successful of the mechanical engineers of our day, may have had their whole course of life determined by their early visits to those exhibitions.

The second thought which has been suggested to me by what I have here observed, is the singular transformation which the industrial arts in many of their departments have undergone since the foundation of your Institute, and even within the more limited period to which my own acquaintance with your exhibitions has extended. If there is in existence a catalogue of one of your annual displays between the years 1830 and 1840, it would I am sure be a matter of very curious interest to compare it with that of the present. One thing would not fail to strike, at the very first glance. There are

matters to which you now give a very large space, which could not have had even so much as a mention in the earlier list. One of these, for instance, is the sewing machine, which, within twenty years, has grown to be a great manufacture, of which the competing varieties are almost countless, and which has profoundly modified every industry dependent on the needle throughout the world. You give at present an entire saloon to this interesting machine, and crowds of admiring spectators are constantly surrounding the operators. An industrial exposition without the sewing machine would seem to us now, deficient in one of the most attractive of its proper features, yet thirty years ago you had no sewing machine, for in 1839 no such machine existed. Another illustration of the same kind I find in photography. The art of photography bridges so completely the interval between the useful and ornamental arts, that it is difficult to decide whether its value is not even greater for purposes of utility than for those of mere embellishment. The most familiar use of photography as the art of portraiture is conspicuously represented on your walls at the present time. In the examples exhibited, will be found striking evidence of the important improvement which has been made in this branch of the art in recent years. But photography is now the efficient handmaid of many of the arts which are strictly industrial. As auxiliary to lithography and printing, it furnishes the means of rapidly and cheaply reproducing printed books without any resort to typography. It aids the wood engraver, by fixing promptly on his block the lines which he is to follow with his burin. In the ceramic arts it fixes expeditiously the designs which are to be burned into the biscuit. The engineer, the architect, the surveyor employ it for multiplying their drawings, or for enlarging or reducing the scale. In the coast survey office of the United States, it has been for many years in daily use, in the preparation for the engraver of the various charts published for the use of our navigators. It is hardly necessary to advert to the value of this process in acquainting us with all that is curious and interesting in art, in architecture and in natural scenery throughout the world. Photography and the stereoscope united annihilate distance, and place us with equal facility in the presence of the ices of the pole, or amid the burning sands of the tropical deserts. Photography has also become of inestimable value, in facilitating the investigations of the historian, the archæologist, and the philologist. Treasured manuscripts which it is not permitted to withdraw from their depositories for critical study

are copied by it with a literal fidelity, which renders the copy as high in authority as the original itself. In like manner venerable inscriptions, hieroglyphics, and other monuments of antiquity of doubtful significancy, situated in localities difficult of access, and, therefore, seen in place only by the few, are reproduced with a fidelity equally unerring, and placed in the hands of all the scholars of the world in their own studies. The exact sciences have also recently found in photography one of their most invaluable auxiliaries. By its aid the moon has been mapped with an accuracy which leaves far behind even the admirable work achieved with so immense an expenditure of labor by Mädler and Baer. You are all of you familiar with the magnificent photographic moon maps by our accomplished townsmen, Mr. Rutherford and Professor Draper, so that I need not dwell upon them here. But Mr Rutherford has further applied photography to the mapping of the lines of the solar spectrum, furnishing the surest means of determining their true relative positions and distances, and thus contributing materially to the advancement of spectroscopic chemistry. The same gentleman has made, also, a still more important application of photography to astronomy. By receiving upon plates of glass the images of whole groups of stars, and by applying a micrometer of extraordinary power to the measurement of the intervals between the several stars of the groups, he has provided a means of fixing the true places of the stars in the heavens, greatly superior to any heretofore employed; while it enables the observer to collect in a single favorable night material for determinations which by previous methods would hardly be gathered in weeks or months. A most competent judge, my friend Dr. Gould, of Cambridge, who has practically tested the value of this method, pronounces it to be the most important contribution to the instrumentalities of practical astronomy which has been made since the invention of the transit instrument, by Roemer. Finally, photography has been extensively applied, during the great total solar eclipses of the past few years, to the purpose of fixing the images of those extraordinary luminous appendages which are seen to border the great source of light while its disk is completely covered by the moon. The brief duration of the entire phenomenon of a total eclipse, the extreme variety of such occurrences, and the unavoidable excitement experienced by the observer during the observation, are circumstance all unfavorable at the moment to the critical study of the appearances presented. But the numerous successful photographs which have been secured in

1860, in 1868 and in 1869, along with the spectroscopic observations simultaneously made, have thrown a flood of light upon this difficult subject, and have contributed greatly to the establishment of a trustworthy theory of the physical condition of the sun. And in connection with this topic, I ought not to omit to state that photography has furnished the best, and I might almost say the only effectual mode yet attempted of investigating the laws which govern the solar spots, as to their appearances and disappearances, as to their periods, and as to their distribution and their varieties, by means of impressions of the sun's disk taken daily for long periods of time, and compared with each other according to a severe mathematical method.

This is far from being an exhaustive enumeration of the uses of photography. Its scientific applications are far more numerous, and new practical uses for it are presenting themselves every day under the observation of all of us. Yet the catalogue of your exhibition of 1839 contains no mention of photography, for in 1839 photography had never been heard of. It was, indeed, in that very year, if my memory serves me, that a statement appeared in the public prints to the effect that some person in Paris had succeeded in permanently fixing the fleeting images of the *camera obscura;* but it is probable that this statement was regarded by most readers rather as an experiment upon the credulity of the public than as a true record of an accomplished fact.

Take another example. In your machine gallery there is at present exhibited, in several forms, a most powerful engine for elevating water, called the centrifugal pump. For simplicity in the mode of applying power, there is nothing in all the machinery of hydraulics to be compared to it. For rapidity of operation, for the compactness of its own bulk as compared with the volume of liquid which it raises in a given time, it is equally without a parallel. This machine has been the means of saving vessels from foundering, when leaking so heavily that all other forms of pump would have been perfectly useless. In your present exhibition it stands among the objects of most prominent interest; but it was unmentioned in your catalogue for 1839, for in that year the centrifugal pump had not been thought of.

Turn for another example to the opposite side of this vast area. You see there a printing press, which, receiving its paper from a continuous roll, without any guidance from human hands, delivers it in finished sheets, printed on both sides, with such rapidity as to keep an attendant fully occupied in removing its completed work. In

1839 the only printing presses which could have been present in your exhibition carried their type upon a horizontal bed, and delivered perhaps one hundred printed sheets where this one delivers a thousand.

Among the machinery illustrative of the textile arts, you have again a novelty as admirable for its ingenuity as it is valuable for its ability. This is the traveling shuttle, by means of which a web of the largest dimensions may be woven as easily at one of the smallest. In the weaving of silk shawls in Italy, I have seen three persons at once fully occupied in throwing the shuttle; one stationed at each end to launch it, and a third placed beneath to advance it where it failed to run its course. This, it is true, was in hand weaving; but it is to be borne in mind that beyond certain limits of breadth in the web, the power loom becomes uncertain in its action, or wholly unavailable. I need not say that this admirable invention would not have appeared in your exhibition of thirty years ago, since, if I am correctly informed, it is in this present exhibition that it has made its first public appearance anywhere. I cannot but regret that its originator had not brought it out a year or two earlier, for I am sure that at the Exposition of 1867 it would have produced a signal sensation, and would have commanded from the jury the highest expression of their approbation.

I might proceed to enumerate many other examples to illustrate how large have been the changes which thirty years have brought about in the industrial arts, as they strike even the observer who looks only upon the surface. There, for instance, is the great manufacture of India rubber, hardly known in 1839, but now extending to an endless variety of objects of daily use. There is the manufacture of paper from wood, grass and straw, which, within the same period, has grown into an important industry; while in the present exhibition we have the process reversed, and wood, for the purposes of joinery, cabinet making, *marqueterie*, and the manufacture of hollow-ware, is produced from paper. There is the important art of galvanoplasty, which thirty years ago had not been thought of, but of which the applications are now even more general than those of photography. By means of this art, not only may all solid objects, of every description which it is desired to reproduce, be faithfully copied, but in the case of valuable structures in metal, liable to corrosion by exposure, it furnishes a complete and permanent protection. It is employed also to harden the surfaces of printers' type; it

is an exceedingly useful auxiliary in the process of heliographic engraving; and it enters more or less into nearly every branch of metallurgic industry. Electrotyped plate for the table has almost wholly superceded, except in the families of the very rich, the use of solid silver; and this certainly without any diminution of the usefulness or the beauty of the objects employed. In the Coast Survey Office of the United States, all maps and charts are originally engraved on copper, but these original plates are never used in the ordinary process of printing; the plates actually used on the press are galvanoplastic copies of the originals, which as they are successively worn out can be easily replaced, as the sharpness of the original engraving is not in the least impaired by the process of copying. The most extraordinary feat in the way of galvanoplastic copy ever produced, was probably that accomplished by the agents of the French government during the first military occupation of Rome. This consisted in making a perfect *fac simile* in copper, and in full size, of the great column of Trajan, two hundred feet in height. This copy is now deposited in the palace of the Louvre, divided, from the necessity of the case, into lengths of some twenty feet each, and is open freely to the inspection of all visitors.

To resume our enumeration—there again is the manufacture of steel, in which the revolution accomplished within the last thirty years is among the most wonderful recorded in the whole history of industry. There are the telegraph and the various forms of telegraphic apparatus—all of which have been created since 1839. If we turn to the chemical arts, there are the varied and brilliant aniline dyes, extracted from a substance, least of all promising results so splendid—the tar of the gas house. There is the metal, aluminum, combining the two important properties of incorrosibility and extreme lightness, for which the uses will rapidly multiply as the cost of production is diminished, and which has already given us a form of bronze having the beauty of gold and the hardness of steel. All these are examples of industrial products or inventions which had no existence in the earlier years of your institution, and which had no part in its earlier exhibitions.

If again we turn our attention to objects which are not new, there is no reason to doubt that we shall find as much to admire in the improved quality of these things as we have found already in the novelty of others. It would, indeed, be exceedingly interesting if it were possible, to compare the beautiful carpets I have seen yonder

with those which were exhibited when you held your annual gathering at the lower extremity of the city, in Castle Garden. We should find a similar interest in comparing the broadcloths, the shawls, the furniture, the hardware, the cutlery, the apparatus for heating and ventilating dwellings, the railroad machinery, the implements and tools of the arts, and even the various fruits and vegetables which are so temptingly arrayed near the entrance of this building, with the corresponding objects of thirty years ago. We should not so much compare for the sake of ascertaining *whether* we had improved, for that may be taken for granted, but we should be curious to discover how much we had improved.

The evidences of progress, which we have been considering, lead to another thought; how wonderfully is the productive power of the human race promoted by the progressive advancement of the industrial arts. In order to understand this, we have only to consider how inefficient, for most useful ends, is the individual man when reduced to dependence upon the unaided efforts of his own hands. It is in this condition that we are to suppose the race to have been originally placed. It is in this condition that we find races still existing, in what we are accustomed to call a state of nature. The producing power of savage races, such as those which have melted away before our own, but which still continue to maintain a precarious existence upon our western plains, is hardly superior to that of the brute creation. It is almost wholly expended in providing for the immediate and pressing wants of daily life, and it accumulates nothing for the future. The first step in the way of advancement from this miserable condition must consist in the production of some species of tools or implements, by means of which the muscular force of man may be more advantageously applied. We may say perhaps that even our aboriginal savages were provided with something of this kind; for such we must regard the bows and arrows, by means of which they brought down their game, and the rude implements of flint or bone, which served them to shape their primitive coverings of skins. It needs no argument to prove that the earliest steps of progress toward what we call the arts of civilization, even on the part of a race in the highest degree improvable, must necessarily be exceedingly slow. Such a progress can never receive a sensible acceleration until man shall have acquired some slight knowledge of the hidden things of nature, and some command over the natural forces. He must know something of metals; he must know how to

extract them from their ores; he must know, of course, the uses and the management of heat; and he must subject, at least, the winds or the falling waters to his mastery. Yet even when he has attained this degree of advancement, there seems to be moral causes preventing so rapid a progress in improvement as might else be possible. For in a semi-barbarous condition of society, the arts of industry are invariably held in contempt, and men's imaginations are preoccupied with the ambition of martial distinction.

This fact was strikingly illustrated in that department of the great industrial exposition of Paris, which was devoted to the history of labor. The objects in this interesting display were so arranged as to exhibit the several successive stages of progress in the arts of industry from the period of the dwellers in the pile villages of Switzerland nearly down to our own time. Almost throughout the entire succession, it is evident that two classes of objects have, in every past age, occupied the minds and employed the hands of artificers almost exclusively; and that these have been, first, weapons and trappings of war; and, secondly, articles of ornament and luxury, designed for the decoration of the persons or the dwellings of the great. In the age of stone, we find arrows, and daggers, and spear heads, laboriously formed of flint, in abundance. In the age of bronze, we find similar objects fashioned of metal, to which may be added, also, swords and shields, finished occasionally with very elaborate ornament. And, along with these, we find here evidence of the fondness for personal ornament of the warriors who bore these weapons, in the presence of heavy armlets and other decorations, while the implements which seem to have an industrial use are few and far between. The early age of iron presents the same characteristics, still more fully developed. Pursuing the examination through the historical period, we find that down to the very close of the sixteenth century, there are among the objects exhibited scarcely any which are not referable to one or the other of the classes above mentioned; although many of the ornamental articles on which wealth had been most lavishly expended, were articles designed to be subservient to religion in the embellishment of churches, or the personal decoration of ecclesiastical dignitaries. During the two centuries which follow, we perceive a change slowly creeping in; but even here, we find the taste for the ornamental still predominant, while in very rare instances does the production of the useful seem to have attained the importance of an extensive manufacture.

Down, therefore, at least to the close of the sixteenth century, the effect of all the improvement attained in the arts of industry (and in many of them this was by no means small), was but very inconsiderably to increase the power of production. Many of the grandest monuments of architecture existing in Europe were founded in those early centuries. Many of the most admirable specimens of metallurgic art, especially in arms and armor, in plate and jewelery, and in the decorations of places and churches, originated during the same period. But while the advancement of the arts in the direction of skillful workmanship attained a high degree of perfection, their power of producing *abundantly* scarcely made any advances at all. It was hardly possible that it should; for while the ambition of artizans was directed mainly to the production of objects of luxury which only the rich could buy, those humbler articles on which the daily comfort of the multitude so largely depends were naturally neglected. In such a state of things, the material condition of the great body of the people of Europe was of necessity lamentably depressed. And so perhaps it might long have continued to be, had not the power of those moral causes which had operated to produce the depression been suddenly and singularly shaken. The invention of the art of printing in the fifteenth century, with the revival of letters in western Europe, and the almost simultaneous outbursting of the storm aroused by the bold movement of Luther in Germany, awakened new modes of thinking and opened the way for a reconstruction of the whole social system. Hitherto, the principle on which society had been organized in Europe, had been distinctly that of consulting the greatest good of the smallest number. Hereafter there was to be an approach gradual indeed, but at any rate an approach, to the opposite principle; and whether governments recognized it or not, the movement of the industrial world was distinctly toward the result of providing for the greatest good of the greatest number. To produce articles of use became now an object of as high ambition as it had previously been to produce articles of luxury. And as the benefit which the producer may derive from his product depends upon the promptness with which it is taken off his hands, it became equally an object of desire to produce useful objects cheaply. Thus began to be increasingly perceived the necessity of calling in, to the aid of man's own limited strength, the exhaustless powers of nature. For a long period the only powers of this kind available had been and continued to be those furnished by wind and falling water; and of these practically

the second was the only one largely useful. The application of water power to industry was certainly an inestimable benefit. It is easily computed that a sheet of water which furnishes only thirty cubic feet per second with a fall of fifteen feet, will exert an aggregate force more than equal to the work of five hundred men ; and as this force can work incessantly, while man is capable of a sustained labor of hardly greater duration than eight hours in the twenty-four, it may be said that the water-power in the case supposed, is equivalent, for every practical purpose, to that of at least fifteen hundred men. If this water were expended upon an over shot wheel, perhaps one-fifth or more of its useful effect might be lost; but making every allowance for this consideration, this simple example shows us the power of an individual man multiplied more than one thousand times. But the force of falling water is as nothing to that which in our day, is derived from the application of steam to the movement of machinery. There are steam engines constructed at present, which are rated at from twelve to fifteen hundred horse power. And it should here be understood that a technical horse power is nearly double that which a horse of average strength can really exert in actual work, while as in the former example, the engine can work constantly, though the horse must rest two-thirds of the time. An engine of 1,500 horse-power will therefore perform in twenty-four hours the work of nearly nine thousand horses, or say of fifty thousand men. We see, then, to what an immense extent the productive power of modern industry has been increased, by the introduction of the steam engine.

The speaker further illustrated this branch of his subject by remarks which it is to be regretted were not reported, and in a brilliant peroration described some of the grand results which are sure to follow from the untiring energy and skill evinced by American inventors, mechanicians and artisans.

THE SILK INDUSTRY OF THE UNITED STATES.

AN ADDRESS DELIVERED AT THE EXHIBITION OF THE AMERICAN INSTITUTE, OCTOBER 28TH, 1869.

By Britton Richardson, Esq.

Ladies and Gentlemen.—The silk trade owes you an apology for not setting before you a fuller assortment of the manufactures of silk than you see here. In explanation, I would only say that the arrangement to exhibit was made rather too late. We hope, however, to do better for you next year.

An apology is also due for not providing a better speaker than the one who now stands before you. Hear me, however, for my cause.

The manufacture of silk is one of the most ancient. Chinese books four thousand years ago particularly describe the culture of silk, and tradition says a Chinese empress was the first to wind and weave it.

Raw silk was exported from China to Persia, Tyre, and elsewhere, where it was woven, and sold to several parts of Europe and Asia.

Aristotle and Pliny speak of it, but seem to have known very little about it, for it was for ages supposed to be a fine down combed from trees. In the island of Cos the woven fabric was unwoven for the purpose of making gauze; and this was also done by the ladies of Rome.

In luxurious Rome so beautiful a material needed only to be known to be highly prized. Its cost was its weight in gold.

In the Augustan age poets sang of it; and in the reign of Tiberius none but ladies of the highest rank wore it. The Roman senate forbade its use by men. A silken garment is mentioned as one of the wanton prodigalities of Heliogabalus. The empress of Aurelian was denied the luxury of a new dress of silk, and her husband sold her accumulated stock of silken garments to replenish his treasury.

Rome was supplied with silk by the Persians; but in the second

century the emperor endeavored to open direct communication with China, and sent ambassadors for that purpose, but his project failed.

During the sixth century a few silkworm eggs were brought in a hollow cane from China to Constantinople by two Persian monks, who had learned how to rear the worms and prepare the silk. This was in the reign of Justinian, who warmly fostered the new industry. The manufacture was long kept in Rome; but Roman conquests facilitated its introduction into Italy.

The cities of Greece became famous for silk manufactures; but for a long time little progress was made westward.

Grecian prisoners of war brought by Roger, king of Sicily, introduced the silk manufacture into Palermo, whence it spread to Venice, Florence, and Milan.

Modena produced the best silk in Lombardy. The silk manufacture was thought a fitting business for the aristocracy of Venice.

As yet, however, there was no silk thrown except in Bologna, and other cities had to send their raw stock there to be prepared for the weaver.

Silk was first introduced into France near the close of the fifteenth century. Workmen were imported from Genoa, Florence, and Venice, and a factory was established at Tours. The experiment failed; but a few years later another factory was started at Lyons, workmen being brought from Milan. It was encouraged and protected by the French monarch, and succeeded. The trade then spread to other parts of France, and grew so that a considerable export trade grew up.

The Moors introduced the manufacture into Spain; and when Granada was captured, successful silk factories were found there.

England now imported silk goods from France, as she had hitherto done from Italy and China; and the extent of the trade, drawing as it did, the gold of England, became alarming. James I. being averse to war, cowardly and pedantic, turned his attention to the silk trade, and strongly urged on his discontented subjects the profits and benefits of silk culture. Owing to climatic disadvantages the experiments which were made failed, and were abandoned. Great progress was, however, made in silk-weaving, and later the settlement of some thousands of refugees from France in Spitalfields, London, made silk a staple industry of England. The French refugees introduced the latest improvements, and from then to the time of the destruction of the English silk trade by the free-trade treaty with France nine

years ago, Spitalfields was the great center of the silk trade in England.

Still, England had no machinery for the throwing of silk or spinning it for the weaver; and as other European cities had to send to Bologna for their silk threads, so England had now to send to France for hers. By force of fraud this difficulty had to be got over. Accordingly, a skillful draughtsman and mechanic went to Italy, disguised as a common workman, and, by bribes, gained access to a silk factory. What he saw there during the day he committed to paper during the night, and at length escaped with two Italian workmen. The three got safely aboard an English ship; and although they were pursued by an Italian vessel, they landed safely in England. The daring adventurer, on his return, established a large factory at Derby for silk spinning. He was, however, shortly after poisoned by Italians sent over for the purpose. The workman died, but the work went on; and soon English-made silks sold in Italy at higher rates than Italian-made silks.

The English protected the silk trade by heavy duties and restrictions, and before the close of the eighteenth century the annual product of the silk industry in England amounted to $17,000,000, giving employment to from 80,000 to 100,000 people.

Although the attempt to raise silk in England failed, the English government was not unmindful of its great importance, and therefore turned its attention to silk culture in the colonies of America, which will be spoken of more at length hereafter.

China raised her own silk, and the countries of Continental Europe raised theirs, and England wanted to raise hers. Now she was obliged to import it from India, China, Italy and Turkey.

Notwithstanding this, the silk trade grew in England, until, in the early part of the present century, the English silk looms numbered 40,000, and in 1855 they had increased to 110,000, consuming 5,500,000 pounds of silk, and producing goods worth $45,000,000. This royal industry is now prostrated, and the cry of distress is heard in the places which were heretofore the great centers of the silk industry.

Hear a voice from Macclesfield, a silk town in the county of Cheshire, once employing 12,000 weavers:

Macclesfield.—Past.

Sir: In the year 1825, and for years preceding, Macclesfield was a rising and prosperous town. The weavers of that period enjoyed

not only the necessaries of life, but many comforts; and in such estimation were they then held that the shopkeepers and tradesmen sought their custom and patronage. In such request was their labor that it was no uncommon thing for the employer to offer £10 or £20 to a master-weaver if he would have his four or five looms supplied with work from him. One respectable firm, to secure the weavers' labor, built a number of houses specially for them; others bought them looms, taking repayment by easy instalments. On every side throwing mills had been erected, and so great was the demand for houses that they were occupied before they were well ready for habitation. Some weavers who were prudent and economical built houses for themselves. Families from the potteries and surrounding towns flocked into Macclesfield in order that they might partake of the increasing prosperity. To provide for the culture of rising generations, Sunday-schools, the national and other day-schools were erected; and at the same time places of worship were built by every denomination. For years the trade and town continued to flourish until Mr. Huskisson took the first step in free trade by tampering with the silk duties. Apprehensions being expressed, he told the silk-weavers of Spitalfields that if they would be patient and allow him to proceed with his contemplated measures, they would not only have roast beef for their dinners, but boiled fowls in addition. At that time it was the daily custom for the London brewers to send round porter to the weavers' houses at noon, as milk is now brought to our doors in a morning. Mr. Huskisson's first alteration came into operation in 1826, from which period the silk trade of the country began gradually to decline. Subsequently we were told that our decline was attributable to the then existing corn laws; and in 1844 Mr. Bright, accompanied by some of his copatriots, came over to Macclesfield to inform the weavers and silk hands that to the repeal of the corn laws they must look for improvement in their trade, and he assured them if they would join the agitation and secure the repeal, their trade, which was on the wane, would speedily revive, and enable their wives and daughters to wear silk dresses on a Sunday. I may here remark that up to 1826, it was not uncommon for the weavers' daughters and the superior factory hands to appear in silk dresses on Sundays, bought on easy terms of payment from their employers. Mr. Bright and an eminent barrister told them if they could only get cheap food, the surplus earnings could be spent on elegant clothes; therefore it may readily be supposed, with such

prospects held out to them, they joined in the cry for cheap food, forgetting that cheap food at that time meant lower wages. At that meeting one or two individuals ventured to tell Mr. Bright and his friends that, having been deceived before time by delusive promises, they were apprehensive the glowing prospects foreshadowed by them might never be realized. A kind-hearted, sympathizing Quaker lady, still living, who had become enthusiastic on cheap food, got up in the meeting, and addressing herself to one who had expressed doubts, said, "Well, if there cannot be a living got at silk, the hands must turn to cotton," which was received with loud acclamations by the meeting.

Present.

In a leading article of the *Times* of Friday last, the 23d inst., it is stated that Macclesfield has now 1,000 empty houses. I would, therefore, suggest to the Lancashire spinners and manufacturers to follow the example of one Lancashire company, which has already commenced spinning on an extensive scale, and has also nearly completed a shed calculated to hold 1,400 looms for cotton. If others would thus similarly invest capital here, the families who were compelled to leave Macclesfield through want of employment, would soon return again and occupy the houses now uninhabited; there being no manufacturing town so pleasantly situated, nor any equal to it for salubrity and cleanliness, with its beautiful park and delightful scenery. It would appear that the time for following what the Quaker lady recommended has now arrived; for one of the London daily journals in its leading article of Saturday last informs the Spitalfields weavers that although "they are sober, industrious, skillful, patient under suffering like their God-fearing Huguenot ancestors, yet their virtues will be of no avail against the inexorable change which has subjected their industry to foreign rivals." This is a serious announcement, and explodes the delusion which some sincere friends have hitherto entertained even in our town, that the struggle was transient, and that ultimately the trade would survive the "temporary derangement." The writer of the article then urges the Spitalfields weavers "to give up their forlorn trade, to leave their wretched garrets, in which they are verging on starvation, in clothing not far removed from nakedness, enduring a misery ever present, and a hopeless future, with nothing but the workhouse, though hateful, as the last resource; and recommends them not to cling to Spitalfields; but to go down to Lanchshire, which wants hands in all its teeming hives,

and offers to the man who is now earning 8s. a week 25s., if he will but go and buckle to, and leave the garrets of Spitalfields for the neat cottage allotments of Lancashire." The picture drawn by the London editor is truly lamentable, and is the more grievous because the misery and wretchedness are brought about not by any fault of the poor weavers themselves, but by "the inexhorable change which has subjected their industry to foreign rivals." It is, however, a remarkable fact, that so recently as 1859, the Manchester manufacturers petitioned Parliament, through Mr. Bright, to at once abolish all the duty on silk manufactured goods, as the trade had nothing to fear from foreign competition; nay, more, they boasted that their courage, their pluck, their skill, talent and ability would soon prove that they were beyond competition; yet, on Saturday last, in a long leading article of Mr. Bright's paper, the *Morning Star*, the Spitalfields weavers, and through them all English weavers, were told to abandon their forlorn trade, which had been ruined by foreign rivals, and not to cling to their native homes, the abode of their God-fearing ancestors, but at once go to Lancashire and "buckle to" power-loom calico weaving. This urgent recommendation may be prompted by pure sympathy for the ruined Spitalfields weavers, although cynics might interpret otherwise. It is easy thus to recommend change of employment; but here is the difficulty. A man who has been employed all his life in the weaving of fine silk, in a quiet garret, with his family around him, could not himself become expert at weaving cotton goods amidst the dim and clatter of a power-loom shed, nor could he reconcile himself to the change; but his young family might become useful hands in the somewhat genial employment of fine spinning in the establishments of Lancashire and Cheshire. Whether the offer will be responded to by accepting employment in the north remains to be seen.

Yours, etc.,

AN OLD SILK HAND.

The cause for this distress is not far to seek.

In 1860, a free-trade treaty was made with France, and it has affected the silk trade of England most adversely. The average importation of silk goods from France before the treaty was £750,000.

For 1860, first year of treaty	£1,303,612
For 1861, second year of treaty......................	1,919,760
For 1862, third year of treaty........................	3,568,553
For 1863, fourth year of treaty	3,683,752
For 1864, fifth year of treaty	4,493,507
For 1865, sixth year of treaty	5,559,090
For 1866, seventh year of treaty	6,694,394

We now come to speak of silk and silk manufactures in our own country.

England always has felt her inability to produce raw silk. As early as the time of James I, the colonists of America were encouraged by bounties, and forced by penalties, to cultivate the mulberry and raise silk. The mother of George III wore a dress of American silk. Earl Chesterfield and President Stiles of Yale also wore robes of American silk; but the raising of silk in this country was never a commercial success.

Great attention was paid to silk-raising in Massachusetts and Connecticut as well as in Pennsylvania and New Jersey before the revolution; and, stimulated by the "*mori multicaulis* fever," the product of raw silk in this country reached, in 1844, 4,000 pounds. And at the last Paris exposition the finest cocoons exhibited were from California.

The first silk factories here were engaged in making sewing silk, in which branch we now beat the world, and hold undisputed possession of the home market.

Notwithstanding the depression which followed the "*mori multicaulis* fever," the silk factories which had been established in Northampton, Mass., Mansfield, Ct., and other places, are now flourishing.

The machinery of a factory at Dedham, Mass., was transferred to Paterson, N. J., whence sprang the Murray mill of that city, from which again sprang the Passaic and other mills in Paterson. The extensive works at Hartford and Manchester show the vitality of the silk industry; they having lived and grown through all hindrances. To the manufacture of sewing silk were added trimmings, upholstery goods, cords and tassels, neck ties, bindings, braids, ribbons, etc.

The fortunes of the trade have varied somewhat with the different policies of the government until the adoption of the present tariff in 1862. Since then the trade has prospered and progressed, a large capital has been invested in it, and it has found steady work and

good wages for many thousands of hands, chiefly women and young persons of both sexes.

For the past four or five years vigorous efforts have been made to weave broad silks, poplins, grosgrains, satins, serges, foulards, etc., for dress goods and other purposes. Of the success of their efforts you may judge from what you see in the silk department of this fair. Some of the goods so made are sold as foreign goods, and some, I am proud to say, are honestly sold as American silks.

May I be allowed here to say a word to the ladies on this matter of prejudice in favor of foreign goods. There is an old saying that "Dear bought and far fetched is good for ladies;" but that saying is not American—it belongs to times of ignorance and to another country.

Ladies, do not, therefore, act upon it. The best ribbons and trimmings you now use are of American make, though sold to you as foreign, and the same applies to many of the silk dress goods you wear; and I know that the American goods are more honestly made and less sophisticated than many of the foreign goods which are "made to sell." I know a lady, the wife of an American silk manufacturer, who went into an up-town store and asked to see some American silks. "Oh!" said the smirking clerk, "we do not keep domestic goods;" and he thereupon showed her as foreign goods some which she knew were made by her husband. While we were arranging for this fair, I asked an American manufacturer to exhibit some of his goods. "Oh!" he replied, "I cannot do that; it would spoil my trade; all my goods are sold as imported goods; and to avoid the domestic taint, they are delivered through a third party."

Daughters of America! rise above this prejudice and buy the goods which are made by the nimble fingers of your poorer sisters. We say prejudice, and we speak advisedly. We have the same raw silk, the same colors, and the same help as the foreigner has. We have better machinery, superior skill, and more enterprise than he has. Therefore, to say that we cannot make as good silks as he can, is to be prejudiced.

The silk trade has never had any such association as the wool trade has; therefore, our statistics are not so full or complete. I hope, before another fair is held, we shall be better prepared in this particular. We can, however, give you some general particulars from which you will gain an idea of the extent of the silk trade at the present time.

We at present import raw silk to the amount of about $6,000,000 per annum, and the value of silk goods made in the United States may safely be taken at $20,000,000.

The greatest silk center is Paterson, N. J., where there are now sixteen factories, running 75,000 spindles, preparing silk threads, that is, throwing silk, mostly for weaving.

The hands employed are 3,500. The wages paid per annum, $500,000. The capital invested, $2,000,000.

In Philadelphia, there are twenty factories, employing 400 men and 1,500 girls and women, whose wages amount annually to $250,000. The capital invested is estimated at $1,500,000.

In the city of New York, there are 7,000 to 8,000 hands employed in making trimmings, weaving ribbons and dress-goods; the invested capital being $2,500,000.

Besides these, we have factories at Yonkers, Schoharie, and other places in New York State; at Hartford, Manchester, Mansfield, Willimantic, and other towns and cities in Connecticut; at Northampton, Florence, Williamsburg, Canton, and other towns in Massachusetts.

We said just now that the silk weavers of the United States can make dress goods equal to those imported; but if the American weaver pays his hands one dollar for the same work for which the foreign weaver pays one franc or one shilling (as a schedule which I have before me shows to be the case), of course he cannot make goods as cheaply as the foreign weaver.

Tom Hood sings of cheapness in his Song of the Shirt, but it is the cheapness of flesh and blood — alas! Sir Morton Peto, in his *Resources of America*, speaking of the burdens borne and the men raised in our gigantic struggle, says, "To what are we to trace all this, to what are we to attribute this? First of all, I must think to the absence of pauperism in the United States, where every man has something to defend."

It is not desirable that the operatives of this country should be reduced to the level of the pauper operatives of Europe, whose paltry wages have to be eked out by public aid; neither is it desirable that a young and growing interest, such as the silk trade, should be crippled or destroyed. The silk manufacturers, therefore, ask for such protection as will enable them, when they expend their capital in and devote their energies to the trade, to compete successfully with the foreign manufacturers in this market.

Cheapness means low wages and misery. This is a grave social question. You have already seen something of the operatives of Macclesfield.

In a paper read by Dr. Farr before the statistical society, he says, "In England, twenty-six children out of every hundred die under five years of age; in the best districts, eighteen; in the town districts, thirty-six perish.

Listen to the report of the factory inspectors of England two years ago:

"That there is a waste of infant life in our manufacturing districts is unhappily too true. Children of tender years do not receive all the mother's care and that nutriment which they require, while the mother is absent at the factory; the children suffer in health, and doubtless many sink under the system; but in no place is there such an enormous mortality as even the reduced amount at Mulhouse; and even if such an institution as that established at Mulhouse were proposed in the manufacturing districts of this country, there is so much independence and self-reliance that it would neither be popular nor acceptable.

"But the evil effects of the employment of the mother in the factory tell much more upon the health and stamina of the infants after her return to her employment. They are frequently put under the care of a woman who takes charge of several, the infants being left with her in the morning, and fetched away at night upon the mother's return from work. Sometimes the mother feeds the child in the middle of the day, if the distance is not too great from the factory; but during the absence of the mother, the child is generally kept quiet by some syrup or cordial prepared expressly, and of which large quantities are prepared and sold in the manufacturing towns.

"The cause of this is that women can earn more in a factory than at any other occupation. A young woman before marriage spends what she earns, and after marriage, her husband, if a factory worker, can not earn sufficient to supply the place of her former wages; and the pleasure of spending being as great as ever, the woman continues her work in the factory, and follows her spendthrift habits.

"The factory system which has grown up in our manufacturing towns requires a treatment adapted to its necessities; and the rearing of the children of women employed in factories is a part of that system which demands thorough investigation and remedy. So long as female labor is so much in request in the manufacturing districts, so

long must we expect the continuance of a preference of the factory to domestic duties; but the sad consequences might be mitigated if proper and well-ordered nurseries were established, were children could be taken care of, for the same charge as is now made by these private nurses. The extent to which children are exposed to risk can not be shown more clearly than by the following extract from the *Ashton Reporter*, of an account of the proceedings of the coroner's inquest upon the death of a child aged six months, who died during the mother's absence at the factory:

"'A juror said there were many married women who would sooner go to the mill than stop at home and nurse their children. Another juror remarked that hundreds of married women in Stalybridge went to the mills in ordinary times, and left their children to be nursed by neighbors. Another juror said that, cold as the weather was that day—and it was the coldest he remembered—children had been dragged out of their beds between five and six in the morning, and taken through the streets in the cold air to the residences of those who nursed them, which were in some cases hundreds of yards off. Another a juror said he had worked in a Lancashire town six years, and had never seen what might be witnessed any working morning in Stalybridge, namely, men going through the streets with cradles in their arms before six o'clock, and women with their babies in their arms, wrapped in shawls, in order to protect them as much as possible.'"

But even with such a social condition and all the suffering and want it suggests, English manufacturers cannot hold their own against other European manufacturers; for there is cheapness elsewhere, and still lower depths of misery.

The following circular, issued from the English Foreign Office, speaks for itself:

Dispatch Addressed by Lord Stanley to Foreign Ministers.

"Foreign Office, *January* 17, 1867.

"*My Lord.*—The extent to which foreign industry and production now competes with that of England, has of late attracted much attention in this country, and it has been publicly stated that increased production abroad, by diminishing profits at home, is tending seriously to effect British commercial interests, and possibly to divert British capital to a more profitable scene of operations.

"The comparatively matured industry and commercial enterprise

of England is now brought into active competition with that of foreign countries, which is daily becoming more developed in proportion as nations emerge from the stagnation consequent on internal troubles, a state of war or of chronic misgovernment.

"National resources which have long lain dormant are now brought into productive existence, and the increased faith reposed in the stability of institutions is giving a surer basis for commercial enterprise.

"Irrespective, therefore, of any questions as to abstract matters of commercial policy, causes are at work which must influence the mutual relations of nations so far as commercial intercourse is concerned; and it becomes a matter of great interest to ascertain the true facts as regards the productive and commercial development in progress abroad, as regards the results which such development is producing on prices and on wages, and especially as regards the position and prospects of those branches of foreign industry which come most immediately into competition with those of this country."

Not to weary you, hear just one of the replies from Belgium:

"The characteristics of the Belgium workmen are steadiness and perseverance, combined with great intelligence in working after models; their habits are not so expensive as those of English artificers; their diet is more humble—they consume less meat, and their bread is seldom purely wheaten or white in quality. Rye, and the cheaper quality of wheat called 'epeautre' enter in great proportion into the composition of the loaf; beer and spirits are both lower in price than in England; they seldom use tea, and the chiccory-root constitutes a very economical and wholesome substitute for coffee.

"Instead of coals and open grates, closed stoves and artificial fuel, made of mere dust of coal and clay worked into lumps, are universally in use."

You are reminded of old Squeers, when he put water to the milk of his pupils, and exclaimed, "Here's richness!" Hear another instance of cheapness; the cheapness of new-born infants. This is from the *London Times:*

"Some time since, one of the most eminent manufacturers of Mulhouse, M. Jean Dollfus, who employes in his establishment 1,100 women, had his attention drawn to the extraordinary mortality among their new-born children, more than forty per cent having died in a few weeks. The cause of this was found to be the want of care; the mothers, having nothing but their wages, were obliged to resume

work, and were consequently unable to give that attention to their infants which their condition required. M. Dollfus resolved that these women should be kept on full wages not only during their confinement, but for six weeks after, without doing any work whatever, except—and this was an indispensable condition—taking care of their children. The success of the experiment having been proved by the decline in the mortality from forty to twenty-five per cent in the course of four years."

Hear another extract, and I have done :

Ignorance in Italy.

"It is proved that, out of the 21,777,334 Italians united under the sceptre of Victor Emanuel, 16,999,701 do not know their letters, while of the remainder, 893,288 can barely read ; thus the number of more or less educated individuals is reduced to 2,623,605 males, and 1,260,640 females. These figures will astonish us less when we learn that in 1863 there were but 29,422 schools, either public or private, frequented by 1,109,224 scholars ; and 255 gymnasiums, as the colleges where students are prepared for the universities are called. Two hundred and nine communities do not possess a single school, either public or private. In 1859, the government of Italy, including Austria, spent annually but eight millions of francs for popular education."

Now, ladies and gentlemen, do you want to see such cheapness in America ? I trow not. With such cheapness, American manufacturers could make goods cheaper than a foreign manufacturer could. But here wages are paid which enables a man to keep his wife at home to nurse the innocents such as are elsewhere slaughtered, and to send the children of tender years to school, instead of to the factory. Of such beneficent results we think the people will say Amen.

CLOSING OF THIRTY-EIGHTH ANNUAL EXHIBITION.

ADDRESSES AND PRESENTATIONS.

The grand fair of the American Institute for 1869 came to a brilliant close last Saturday evening, Oct. 30, after an unprecedented career of nearly eight weeks. The high-arched and gayly-lighted rink was thronged with the largest crowd of the season, and the thousands of visitors scanned the exhibition and listened to the exercises with much interest. Soon after 8 o'clock, Hon. Orestes Cleveland, chairman of the Board of Managers, announced that Mayor Hall, who was expected to deliver the closing address, had been called out of the city in consequence of illness in his family, but that his place would be filled by Horace Greeley, who was received with applause, and remarked that, notwithstanding the inconvenience of location the exhibition was a great success, for daily and nightly it had been crowded during its continuance. He had also been agreeably disappointed in the character of the exhibition, as there never before, on the continent, had been collected so large and varied a stock of the products of woolen industry. Woolen fabrics had come from the shores of the Pacific, as well as from Iowa, Minnesota and Missouri, and other parts which were wildernesses ten years ago; and he expected that before twenty years would have elapsed the unknown regions of the West would have their wool-growers and manufacturers. He spoke in the highest terms of the many steam engines on exhibition; of the new patent, positive motion loom, which he considered the greatest improvement yet made of the kind, and of the electrical engine, which had demonstrated that electricity could be used as a motive power; a power that, in his opinion, would yet supersede the use of steam. He defended the judges who decided on the awards, from any charges of partiality which may be brought against them, and said that though there might have been a few awards which seemed to have been partial, yet he believed all would be the result of conscientious convictions. In conclusion, he observed, that in the year 1876, on the centennial anniversary of the

day of independence, they hoped to open the grandest exhibition the world ever saw—to show that during the lapse of those hundred years America had worked out her independence, not only in a political, but in an industrial sense.

At the close of Mr. Greeley's address Mr. Kingsbury, superintendent of the wool manufacturers' exhibition, presented to the Institute, through Mr. Cleveland, a magnificent American flag, made by the United States Bunting Company, of Lowell, Mass. Mr. Cleveland received the flag on behalf of the Board of Managers, and said: We accept the flag presented by the United States Bunting Company, of Lowell, and shall take great pride in hoisting it over the future exhibitions of American industry. We shall be the more proud of it because it will be the first time an American flag, made of American bunting, will ever have floated over an American exhibition, and it will be an apt token of our progress in the manufacture of textile fabrics. We shall further treasure it as a reminder of the magnificent display the National Association of Wool Manufacturers has make in this fair. We believe every true American should be proud of your department. You have shown reps, mohair, poplins, lastings, and other fabrics not before made here, and cloths, blankets, and other products of the finest character. Your *Axminster carpets*—of which the imported article costs at retail here from six to seven dollars a yard, you have exhibited of EQUAL QUALITY, at about four dollars a yard; and the best part of it is that the European carpet is woven *by hand*, while the American is woven by *power looms;* and that while the imported has a miserably weak back, that lasts but a short time, the American article has a firm back that never wears out. It is like the back-bone of the American people—you cannot wear it out. [Applause.]

We claim that we have shown five of the best stationary steam engines ever placed on exhibition. You have seen in operation Lyall's positive motion loom, entirely new and never before exhibited, one of the most important improvements in the manufacture of textile fabrics, perhaps taking rank next to the cotton gin. The Bullock printing press, feeding itself, cutting the paper to a suitable size, printing both sides at once, and throwing off newspapers at the rate of 20,000 an hour.

We have shown cotton in the raw material, before your very eyes carried through all the various processes and brought out a spool of thread, and handed to the lady visitors for trial. Agricultural imple-

ments of every kind, vastly improved and simplified, so that skilled labor is no longer necessary to operate them, but the best reapers and mowers may now be operated by the boys on the farm ; a horse rake is shown that will do the labor of twenty men, and machines that destroy the occupation of the milk-maid. Instead of the *root of a tree*, with which by great labor they tore open the bosom of mother earth in ancient times, that they may feed upon its richness, we show you the steel plow which polishes itself as it goes, and gives the happy plowman time to sing his independent song. We introduced to the visitors Mr. Greeley, who delivered the opening address ; Dr. Loring, of Massachusetts, who spoke upon the agricultural interests of the country; the Hon. Samuel S. Fisher, Commissioner of Patents at Washington, who addressed you on behalf of inventors, and of the value of the patent offices in encouraging inventions, and who told you that they had acted upon 14,000 inventions during 1869 ; Erastus B. Bigelow, Esq., President of the " National Association of Wool Manufacturers," who addressed the people on behalf of the wool interests that you represent at this fair.

President Barnard, of Columbia College, who spoke of the influence of mechanism in developing the material resources of the country and Mr. Britton Richardson, of Yonkers, N. Y., on behalf of the silk manufacturers, whose productions in this exhibition have surprised thousands, and are a credit to the American people, and I am proud to say that the most of them come from my own State of New Jersey. It is not to much to say that an exhibition of this extent and character, entirely of American productions, has never before been held, and we have to announce that another exhibition will be held in this build in the autumn of 1870, and that a grand exhibition of the industry of all nations will be held in 1876, under the auspices of the American Institute. [Loud applause.]

The list of premiums was then read, which will be found in preceding pages. The fair of 1869 has been the most successful of any ever held by the Institute, and was visited by more than 150,000 persons.

SCIENTIFIC LECTURE—I.

THE BATTLE-FIELDS OF SCIENCE.

By Hon. Andrew D. White, President of Cornell University.

The first of the winter course of Scientific Lectures before the American Institute, was delivered on Friday evening, December 17, at the hall of the Cooper Union, by Andrew D. White, LL. D., President of Cornell University, the subject being "The Battle-Fields of Science." The lecturer was introduced by Prof. S. D. Tillman, Secretary of the Institute, who said:

Ladies and Gentlemen.— Owing to the unavoidable absence of our president, Mr. Greeley, it devolves upon me to introduce the speaker of the evening. The decided success of our course last winter has induced the trustees of the American Institute to pursue the plan of presenting Science in her most attractive garb. Last year the lectures were mainly devoted to a description of philosophical instruments, their uses, and the laws they elucidate. This year a majority of the lectures will have a direct bearing on the physical well-being of man. In addition to these, one will be devoted to a description of one of the most remarkable formations of the earth's crust, found on our own continent, and another will treat of a subject which is now attracting a great deal of attention, namely: "The Constitution of the Sun." I now have the pleasure of introducing Dr. A. D. White, President of Cornell University.

Mr. White, on coming forward, was received with applause. He spoke as follows:

Ladies and Gentlemen.—In view of the fact that my studies have been rather in history than in natural science, it has seemed to me not unfit that I begin this series of lectures with a historical sketch bearing upon the great subject of your course. I purpose, then, to present to you this evening an outline of the great sacred

struggle for the liberty of science; a struggle which has been going on for so many centuries. A tough contest this has been! A war continued longer, with battles fiercer, with sieges more persistent, with strategy more vigorous than in any of the comparatively petty warfares of Alexander, or Cæsar, or Napoleon. I shall ask you to go with me through some of these most determined sieges, and over some of the hardest fought battle-fields of this great war. We will look well at the combatants; we will listen to the battle cries; we will note the strategy of leaders, the cut and thrust of champions, the weight of missiles, the temper of weapons.

My subject, then, shall be "The Warfare of Science."

My thesis, which, by a historical study of this warfare I expect to develop, is the following: In all modern history, interference with science in the supposed interest of religion, no matter how conscientious such interference may have been, has resulted in the direst evils both to religion and science, and *invariably*. And, on the other hand, all untrammeled scientific investigation, no matter how dangerous to religion some of its stages may have seemed temporarily to be, has invariably resulted in the highest good of religion and science. I say *invariably;* I mean exactly that. It is a rule to which history shows not one exception. It would seem, logically, that this statement could not be gainsayed. God's truth must agree, whether discovered by looking within upon the soul, or without upon the world. A truth written upon the human heart to-day, in its full play of emotions or passions, cannot be at any *real* variance even with a truth written upon a fossil whose poor life was gone millions of years ago. And this being so, it would also seem a truth irrefragable that the search for each of these kinds of truth must be followed out in its own lines by its own methods, to its own results, without any interference from investigators along other lines by other methods; and it would also seem, logically, that we might work on in absolute confidence that whatever, at any moment, might seem to be the relative positions of the two different bands of workers, they must at last come together, for truth is one. But logic is not history. History is full of interferences which have cost the earth dear. Strangest of all, some of the most direful of them have been made by the best of men, actuated by the purest motives, seeking the noblest results. These interferences and the struggle against them make up the warfare of science. One statement more, to clear the ground. You will not understand me at all to say that

religion has done nothing for science. It has done much for it. The work of christianity has been mighty indeed. Through these 2,000 years it has undermined servitude, mitigated tyranny, given hope to the hopeless, comfort to the afflicted, light to the blind, bread to the starving, life to the dying; and all this work continues. And its work for science, too, has been great. It has fostered science often, and developed it; it has given great minds to it, and but for the fears of the timid, its record in this respect would have been as great as in the other. Unfortunately, religious men started, centuries ago, with the idea that purely scientific investigation is unsafe; that theology must intervene. So began this great modern war.

Cosmography.

The first typical battle-field to which I call attention is that of Cosmography, the simplest elementary doctrine of the earth's shape, surface and relations. Bear with me as I go over a field so well known to so many of you. We cannot overlook it if we are to understand other battles which follow. Among the legacies of thought left by the ancient world to the modern were certain ideas of the rotundity of the earth. These ideas were vague; they were mixed with absurdities, but they were *germ* ideas, and, after the barbarian storm which ushered in the modern world had begun to clear away, these germ ideas began to bud and bloom in the minds of a few thinking men, and these men hazarded the suggestion that the earth is round—is a globe. The greatest and most earnest men of the earth took fright at once. To them the idea of the earth's rotundity seemed fraught with dangers to Scripture, by which, of course, they meant *their interpretation* of Scripture. Among the first attempts made was that of Eusebius. He endeavored to turn off these ideas by bringing science into contempt. He endeavored to make the innovators understand that he and the Fathers of the Church generally despised all such inquiries. Speaking of these innovators he said: "It is not through ignorance of the things admired by them, but through contempt of their useless labor that we think little of these matters—turning our souls to the exercise of better things." Lactantius asserted the new ideas to be "empty and false." But this attempt to "flank" the little phalanx of thinkers did not succeed, of course. Even such men as Lactantius and Eusebius cannot pooh-pooh down a great new scientific idea. The little band of thinkers went on, and the doctrine of the rotundity of the

earth naturally led to consideration of the tenants of the earth's surface, and another old germ idea was warmed into life—the idea of the existence of Antipodes. At this the war commenced in bitter earnest. Those great and good men determined to fight. To all of them such doctrines seemed dangerous, to most of them they seemed damnable. Basil and Ambrose were tolerant enough to allow that a man might be saved who believed the earth to be round, and inhabited on its opposite sides; but the great majority of the Fathers of the Church utterly denied the possibility of salvation to such misbelievers. Lactantius asks: "Is it possible that men can be so absurd as to believe that the crops and trees on the other side of the earth hang downward, and that men there have their feet higher than their heads? Do you ask how they defend these monstrosities; how things do not fall away from the earth on that side? They reply that the nature of things is such that heavy bodies tend toward the center, like the spokes of a wheel; while light bodies, such as clouds, smoke and fire tend from the center toward the heavens on all sides. Now I am really at a loss what to say of those who, when they have once gone wrong, steadily persevere in their folly, and defend one absurd opinion by another." Augustin seems inclined to yield a little regarding the rotundity of the earth; but fights the idea that men exist on the other side of the earth, because, as he says, Scripture speaks of no such descendants of Adam. But this did not avail to check the idea, What might be called the flank movement, as represented by Eusebius, had failed. The direct battle given by Lactantius, Augustine and others had failed; in the sixth century, therefore, the opponents of the new ideas built a great fortress and retired into that. It was well built and well braced. It was nothing less than a great complete theory of the world, based upon the literal interpretation of texts of Scripture, and its architect was Cosmas. According to Cosmas the earth is a parallelogram, flat, and surrounded by four great seas. At the outer edges of these seas rise immense walls closing in the whole structure. These walls support the vault of the heavens, whose edges are cemented to the walls. Walls and vault shut in the earth and all the heavenly bodies. The whole of this theologic, scientific fortress was built most carefully, and was then thought, most scripturally. Starting with the expression applied, in the ninth chapter of Hebrews, to the tabernacle in the desert, he insists, with other interpreters of his time, that the original Greek words mean, "made like the world."

This gives a key to the whole construction. The universe is therefore made on the plan of the Jewish tabernacle; box-like and oblong. Coming to details, he quotes those grand words of Isaiah: "It is he that sitteth upon the circle of the earth; * * * that stretcheth out the heavens like a curtain, and spreadeth them out like a tent to dwell in." And the passage in Job, which speaks of the spreading out of the sky. He turns all that splendid and precious poetry into a prosaic statement, and gathers therefrom, as he thinks, treasures for science. To find the character of the surface of the earth, Cosmas studies the table of shew bread in the tabernacle. The dimensions of that table prove to him that the earth is flat, and twice as long as broad. The four corners of the table symbolize the four seasons; the three loaves of shew bread at each corner symbolize the three months in each season. This vast box is divided into two compartments, one above the other. In the first of these men live, and stars move, and it extends up to the first vault or firmament, where live the angels; a main part of whose business is to push and pull the sun and planets to and fro. Next he takes the text, "Let there be a firmament in the midst of the waters, and let it divide the waters from the waters;" and other texts from Genesis. To these he adds the text from the Psalms: "Praise him ye heaven of heavens and ye waters that be above the heavens!" turns that glorious outburst of poetry into his crucible with the other texts, and after subjecting them all to sundry curious processes, brings out the theory that over this first vault is a vast cistern containing the waters. He then takes the expression in Genesis regarding the "windows of heaven," and establishes a doctrine regarding the regulation of the rain which is afterward supplemented by the doctrine, that the angels not only push and pull the heavenly bodies to *light* the earth, but also open and close the windows of heaven to *water* it. To account for the movement of the sun, Cosmas asserts that to the north of the earth is a great mountain, and that at night the sun is carried behind this. Some of the commentators, however, venture to express a doubt here. They thought that the sun was pushed into a great pit at night and pulled out in the morning."

Such was the great fortress built against human science in the sixth century by Cosmas, and it stood. The innovators attacked it in vain. The greatest minds in the Church devoted themselves to buttressing it with new texts, and throwing out new outworks of theologic reasoning.

Columbus is the next warrior. The world has heard of his battles; how the Bishop of Ceuta worsted him in Portugal; how, at the Junta of Salamanca, the theologians overwhelmed him with quotations from the Psalms, from St. Paul and from St. Augustine. But in 1519 comes a great victory. Magalhaens makes his great voyages. He has proved the earth to be round; for in these voyages and others he has virtually circumnavigated it. He has proved the doctrine of the antipodes, for he has seen the men of the antipodes. But even this does not end the war. Many earnest and good men oppose the doctrine for two hundred years longer. Then the French astronomers make their measurements of degress in equatorial and polar regions, and add to other proofs that of the lengthened pendulum. When this was done; when the deductions of science were seen to be established by the simple test of measurement, beautifully, perfectly; then, and then only, this war of twelve centuries ended.

And now what was the result of this war? The efforts of Eusebius and Lactantius to deaden scientific modes of thought, the efforts of Augustine to combat it, the efforts of Cosmas to stop it by dogmatism, the efforts of Boniface, and Zachary, and others to stop it by force, conscientious as they all were, had resulted in what? Simply in forcing into many noble minds that most unfortunate conviction that science and religion are enemies—simply in drawing away from religion hosts of the best men in all those centuries. The result was wholly bad. No optimism can change that verdict. On the other hand what was gained by the warriors of science for religion? Simply a far more ennobling conception of the world, and a far truer conception, and more devout reliance upon Him who made and sustained it. Which is the more consistent with a great, true religion, the cosmography of Cosmas or that of Isaac Newton?

Astronomy.

The next great battles to which I ask your attention, were fought on a question relating to the *position of the earth among the heavenly bodies.* The struggle regarding geography, which I have already presented, was entangled with this. Often, on the same field, the battle was fought for both; but I separate them that we may see each more clearly. On one side, the great body of conscientious religious men planted themselves firmly on the Geocentric doctrine—the doctrine that the earth is the center, and that the sun and planets revolve about it. The doctrine was old and of the highest respectability.

The very name, Ptolemaic theory, carried weight. It had been elaborated until it accounted well for the phenomena. Exact textual interpreters of scripture cherished it, for it agreed with what they supposed the reading of sacred text. Still, the germs of the Heliocentric theory had been planted long before, and well planted; it had seemed ready even to bloom forth in the mind of Cardinal de Cusa, but the chill of dogmatism was still over the earth, and up to the beginning of the sixteenth century there had come to this great truth neither bloom nor fruitage. Quietly, however, the soil was receiving enrichment, and the air warmth. The processes of mathematics were constantly improved, the heavenly bodies were steadily though silently observed, and at length appeared, afar off from the centers of thought, on the borders of Poland, a plain, simple-minded scholar, who first fairly uttered to the world the truth now so commonplace, then so astounding, that the sun and planets do not revolve about the earth, but that the earth and planets revolve about the sun, and that man was Nicolas Kopernik. Kopernik had been a professor at Rome, but as this truth grew within him, he seemed to feel that at Rome he was no longer safe. Returning to his own country, he found it wretchedly inhospitable; but he thought on, and that great central truth of astronomy developed in his mind ever more and more. To publish it was dangerous indeed, and for thirty-six years it lay slumbering in the minds of Kopernik and the friends to whom he had privately intrusted it. At last he prepares his great work on the Revolution of the Heavenly Bodies, and dedicates it to the Pope himself. The work was intrusted to the scholar Osiander, of Nuremberg, to superintend its publication. But at the last moment the courage of Osiander failed him. He dared not launch the new thought boldly. He writes a groveling preface, endeavors to excuse Kopernik for his novel idea. He inserts the apologetic lie that Kopernik propounds the doctrine of the movement of the earth not as a *fact*, but as a *hypothesis*. He declares that it is lawful for an astronomer to indulge his imagination, and that this is what Kopernik has done. Thus was the greatest and most ennobling, perhaps, of scientific truths, a truth not less ennobling to religion than to science, forced, in coming into the world, to sneak and crawl.

On the 24th of May, 1543, the newly printed book first arrived at the house of Kopernik. It was put into his hands, but he was on his death-bed. A few hours later and he was beyond the reach of fanatics and bigots, whose consciences would have blotted his repu-

tation, and, perhaps, have destroyed his life. Yet not wholly beyond their reach. Even death could not be trusted to shield him. There seems to have been fear of vengeance upon his corpse; for on his tombstone was placed no record of his life-long labors, no mention of his great discovery. There were graven upon it affecting words, which may be thus simply translated: "I ask not the grace according to Paul; not that given to Peter. Give me only the favor which Thou didst show to the thief on the cross." Not till thirty years after did a friend dare write on his tombstone a memorial of his discovery. The book was taken in hand at once by the proper authorities. It was solemnly condemned; to read it was to risk salvation, and the world accepted the decree. Many minds had received this new truth; only one tongue dared utter it. The new warrior was that strange mortal, Jordano Bruno. He was hunted from land to land, until at last he turns on his pursuers and writes fearful satires on the church. For this he is imprisoned six years, then burned alive, and then his ashes are scattered to the winds.

But the new truth lived. It would not be stifled. Within ten years after the execution of Bruno the truth of the doctrine of Kopernik was established by the telescope of Galileo. Herein was fulfilled one of the most touching of prophecies. Years before, the enemies of Kopernik had said to him, "If your doctrine were true, Venus would show phases like the moon." Kopernik answered, "You are right; I know not what to say, but God is good, and will in time find an answer to this objection." The God-given answer came when the rude telescope of Galileo showed the phases of Venus. On this new champion, Galileo, the attack was tremendous. The supporters of what was called "sound learning" declared his discoveries deceptions and his announcements blasphemy. Semi-scientific professors attacked him with sham science; earnest preachers attacked him with perverted Scripture.

Atheist and Infidel.

The principal weapons in the combat are worth examining. They are very easily examined; you may pick them up on any of the battle-fields of science, but on that field they were used with more effect than on almost any other. These weapons were two epithets—the epithets "Infidel" and "Atheist." These can hardly be classed with civilized weapons; they are burning arrows; they set fire to great masses of popular prejudices. Smoke rises to obscure the real questions.

Fire bursts out at times to destroy the attacked party. They are poisoned weapons. They go to the heart of loving women; they alienate dear children; they injure the man after life is ended, for they leave poisoned wounds in the hearts of those who loved him best —fears for his eternal happiness, dread of the divine displeasure. The battle-fields of science are thickly strewn with these. They have been used against almost every man who has ever done anything for his fellow-men. The list of those who have been denounced as infidel and atheist includes almost all great men of science—general scholars, inventors, philanthropists. The deepest Christian life, the most noble Christian character has not availed to shield combatants. Christians like Isaac Newton and Pascal, and John Locke and John Howard, have had these weapons hurled against them. Nay, in these very times we have seen a noted champion hurl these weapons against John Milton, and with it another missile which often appears on these battle-fields—the epithets of "blasphemer" and "hater of the Lord." Of course, in these days, these weapons, though often effective in disturbing the ease of good men, and, though often powerful in scaring women, are somewhat blunted. Indeed, they not infrequently injure assailants more than assailed. So it was not in the days of Galileo. These weapons were then in all their sharpness and venom. The first champion who appears against him is Bellarmine, one of the greatest of theologians and one of the poorest of scientists. He was earnest, sincere, learned, but made the fearful mistake for the world of applying direct literal interpretation of Scripture to science. The consequences were sad, indeed. Could he with his vast powers have taken a different course, humanity would have been spared the long and fearful war which ensued, and religion would have been saved to herself thousands on thousands of the best and brightest men in after ages. The weapons which men of Bellarmine's stamp used were theological. They held up before the world the dreadful consequences which must result to Christian theology were the doctrine to prevail that the heavenly bodies revolve about the sun, and not about the earth.

Science and the Bible.

Their most tremendous theologic engine against Galileo was the idea that his pretended discovery vitiated the whole Christian plan of salvation. Father Le Gazre declared that it cast suspicion on the doctrine of the Incarnation; others declared that it upset the whole basis of theology; that if the earth is a planet, and only one among

several planets, it cannot be that any such great things have been done especially for it, as the Christian doctrine teaches. If there are other planets—since God makes nothing in vain—they must be inhabited, but how can these inhabitants be descended from Adam; how can they trace back their origin to Noah's ark; how can they have been redeemed by the Savior? In addition to this prodigious engine of war, there was kept up a terrific fire of smaller artillery in the shape of texts and Scriptural extracts. Some samples of these weapons may interest you. When Galileo had discovered the four satellites of Jupiter, it was denounced as impossible and impious. It was argued that the Bible clearly showed, by all applicable types, that there could be only seven planets; that this was proved by the seven golden candle-sticks of the Apocalypse; by the seven branched candle-stick of the Tabernacle, and by the seven churches of Asia. In a letter to his friend Renieri, Galileo gives a sketch of some of the dealings of the inquisition with him. He says "the Father Commissary Lancio was zealous to have me make amends for the scandal I had caused in sustaining the idea of the movement of the earth. To all my mathematical and other reasons he responded nothing but the words of Scripture. *Terra autem in æternum stabit.*" It was declared that the doctrine was proved false by the standing still of the sun for Joshua; by the declarations that "the foundations of the earth are fixed so firmly that they cannot be moved," and that the sun "runneth about from one end of heaven to the other." The Dominican Father Catticini preached a sermon from the text: "Ye men of Galilee, why stand ye gazing up into heaven," and this wretched pun was the beginning of a series of sharper weapons. For the final assault, the park of heavy artillery was at last wheeled into place. You see it on all the scientific battle-fields. It consists of general denunciation, and Father Melchior Inchofer of the Jesuits brought his artillery to bear well on Galileo with the declaration, that the opinion of the earth's motion is of all heresies the most abominable, the most pernicious, the most scandalous; that the immobility of the earth is thrice sacred. That arguments against the immortality of the soul, the creation, the incarnation, &c., should be tolerated sooner than argument to prove that the earth moves. In vain did Galileo try to prove the existence of satellites by showing them to the doubters through his telescope; they either declared it impious to look, or, if they did see them, declared them illusions from the devil. In vain did he try to protect himself by his famous letter to the

Duchess, in which he insisted that theological reasoning should not be applied to science. The rest of the story the world knows by heart. None of the recent attempts have succeeded in mystifying it. The whole world will remember forever how Galileo was subjected certainly to indignity and to imprisonment, possibly to physical torture; how he was at last forced to pronounce publicly and on his knees his recantation as follows: "I, Galileo, being in my 70th year, being a prisoner and, on my knees and before your eminences, having before my eyes the Holy Gospels, which I touch with my hands, abjure, curse, and detest the error and heresy of the movement of the earth." He was vanquished indeed, for he had been forced, in the face of all coming ages, to perjure himself. His books were condemned;* his friends not allowed to erect a monument over his bones; to all appearance his work was overthrown.

Position of the Church—Descartes and Kepler.

Do not understand me here as casting blame on the Roman church as such. It must in fairness be said that some of its best men tried to stop this great mistake, but the current was too strong. The whole of the civilized world was at fault, Protestant as well as Catholic, and not any particular part of it. Were there time, I would refer at length to some of the modern mystifications of the history of Galileo. One of the latest seems to have for its groundwork the theory that Galileo was condemned for a breach of good taste and etiquette. But those who make this defense make the matter infinitely worse for those who committed this great wrong. They deprive it of its only palliation; mistaken conscientiousness.

And then Kepler comes. He leads science on to greater victories. He throws out the minor errors of Kopernik. He thinks and speaks as one inspired. His battle is severe; Protestants in Styria and at Tübingen, Catholics at Rome press upon him, but Newton, Huyghens and the other great leaders follow, and to science remains the victory. And yet the war did not wholly end. Toward the end of the seventeenth century even Bossuet, the Eagle of the Meaux, most sublime of religious thinkers, declared for the Ptolemaic theory as the Scriptural theory; and, in 1746, Boscovitch, the great mathematician of the Jesuits, used these words: "As for me, full of respect for the Holy Scriptures and the decree of the Holy Inquisition, I regard the earth as immovable. Nevertheless, for simplicity

*Letronne.

in explanation, I will argue as if the earth moves; for it is proved that in the two hypotheses the appearances favor that idea." Nor has the opposition failed even in our own time. On the 5th of May, 1829, a great multitude assembled at Thorn to commemorate the 300th anniversary of Kopernik, and to unvail Thorwaldsden's statue of him.

APOTHEOSIS OF KOPERNIK.

Kopernik had lived a pious, Christian life. He was well known for unostentatious Christian charity. With his religious belief no fault had ever been found; he was a canon of the church of Frauenburg, and over his grave had been written the most touching of Christian epitaphs. Naturally, then, the people expected a religious service. All was understood to be arranged for it. The procession marched to the church and waited; the hour passed; no priest appeared; none could be induced to appear. Kopernik, simple, charitable, pious, one of the noblest gifts of God to the service of religion, as well as science, was still held to be a reprobate. Seven years after that his book was still standing on the index of books prohibited to Christians. Nor was this feeling confined merely to the more ancient church. Perhaps the most striking outcropping of the old feeling was seen in 1868 at Berlin. A large body of Protestants had assembled to protest against what they deemed dangerous science. In their midst stood up a clergyman of note, and declared against the Copernican theory as unscriptural.

SOME OF THE RESULTS.

And now, what was won by either party in this long and terrible war? The party which would subordinate the methods and aims of science to those of theology, though in general obedient to deep convictions, had given to Christianity a series of the worst blows it had ever received. They had made large numbers of the best men in Europe hate it. Why did Ricetto, and Bruno, and Yanini, when the crucifix was presented to them in their hour of martyrdom, turn from that blessed image with loathing? Simply because Christianity had been made to them identical with the most horrible oppression of the mind. Worse than that, these well-meaning defenders of the faith had wrought into the very fiber of the European heart that most unfortunate of all ideas—the idea that there is a necessary antagonism between science and religion. Like the landsman who lashes himself to the anchor of the sinking ship, in the sight of all men, by the strongest

cords of logic which they could spin, they had attached the great fundamental doctrines of Christianity to these mistaken ideas in science, and the advance of knowledge had engulphed them. On the other hand, what has science done for religion? Simply this, Kopernik, escaping persecution only by death; Jordano Bruno burned alive as a monster of impiety; Galileo tortured and humiliated as the worst of misbelievers; Kepler hunted alike by Protestants and Catholics, had given to religion great new foundations, great new ennobling conceptions, a great new revelation of the might of God. Under the old system we have that princely astronomer, Alphonso of Castile, seeing the poverty of the Ptolemaic system, yet knowing no other, startling Europe with the blasphemy, that if he had been present at creation he could have suggested a better order of the heavenly bodies. Under the new system you have Kepler, filled with a religious spirit, exclaiming, "I do think the thoughts of God." The difference in religious spirit between these two men marks the conquest gained in the war by science for religion.

The next great series of battles to which I would turn with you were fought on those great fields occupied by such sciences as *Chemistry and Natural Philosophy*. Even before these sciences were out of their childhood—while yet they were tottering mainly toward childish objects and by childish steps—the champions of that same old mistaken conception of rigid Scripture interpretation began the war. The catalogue of chemists and physicists persecuted or thwarted would fill volumes.

Other Battle-Fields.

There are many other battle-fields of science for which we have no time. Interesting would it be to look over the field of meteorology, beginning with the conception, supposed to be Scriptural, of angels opening and shutting the windows of heaven, and letting out the waters above the firmament upon the earth, continuing through the battle of Fromundus and Bodin, down to the onslaught upon Lecky in our own time, for drawing a logical and purely scientific conclusion from the doctrine that meteorology is obedient to laws.

Anatomy and Medicine.

But I pass to fields of more immediate importance to us, those of *anatomy and medicine*. It might be supposed that the votaries of sciences like these would be suffered to escape attack. Unfortunately they have had to stand in the thickest of the battle. As far

back as the latter part of the thirteenth century, Arnold de Villa Nova was a noted physician and chemist. The missile usual in such cases was hurled at him. He was charged with sorcery and dealings with the devil. He was excommunicated, and driven from Spain. Such seemed the fate of all men in that field, who gained even a glimmer of new scientific truth. Men even like Cardan, and Paracelsus, and Porta, who pandered to popular superstition, were at once set upon if they ventured on any other than the path which the church thought sound, the insufficient path of Aristotelian investigation. We have seen that the weapons used against the astronomers were mainly the epithets infidel and atheist. We have also seen that the principal missiles against chemists and physicists, were the epithets sorcerer and leaguer with the devil, and we have picked up on various battle-fields another effective weapon, the epithet Mahometan. On the heads of the anatomists and physicians were concentrated *all* these missiles. The charge of atheism ripened into a proverb: "*Ubi sunt tres medici ibi sunt duo athei.*" (Where you find three physicians, you find two atheists.) Magic seemed so common a charge that many of the physicians seemed to believe it themselves. Mahometanism and Averroism became almost synonymous with medicine, and Petrarch stigmatized Averroists as men who denied genius and barked at Christ. Not to weary you with the details of earlier struggles, I will select a great benefactor of mankind, and champion of scientific truth, at the period of the revival of learning and the reformation, Andreas Vesalius, the founder of the modern science of anatomy. The battle waged by this man is one of the glories of our race. The old methods were soon exhausted by his early fervor, and he sought to advance science by strictly scientific means, by patient investigation, and by careful recording of results. From the outset Vesalius proved himself a master. In the search for real knowledge he braved the most terrible dangers. Before his time, the dissection of the human subject was thought akin to sacrilege. Occasionally, some anatomist like Mundinus had given some little display with such a subject, but for purposes of *investigation* it was placed among things forbidden. Through this sacred conventionalism Vesalius broke without fear. Braving ecclesiastical censure and popular fury, he studied his science by the only method which could give useful results. No peril daunted him. He haunted gibbets and charnel-houses to secure the material for his investigations. In his search he risked alike the cruelty of the inquisition and the virus of the plague. First of all

men, he began to place the great science of human anatomy on its solid modern foundations, on careful examination and observation of the human body. This was his first great sin, and it was soon aggravated by one considered even greater.

Mistakes of the Church.

Perhaps the most unfortunate thing that has ever been done for Christianity, is the tying it to forms of science and systems of education which are doomed and gradually sinking. Just as in the time of Roger Bacon, excellent but mistaken men devoted all their energies to binding Christianity to Aristotle. Just as in the time of Reuchlin and Erasmus, they insisted on binding Christianity to Thomas Aquinas, so in the time of Vesalius, such men gave all their efforts to linking Christianity to Galen. The cry has been the same in all ages. It is the same which we hear in this age against scientific studies, the cry for what is called "*sound learning.*" Whether standing for Aristotle against Bacon, or Aquinas against Erasmus, or Galen against Vesalius, or making mechanical Greek verses at Eton, instead of studying the handiwork of the Almighty, or reading Euripides with translations, instead of Lessing and Goethe in the original, the cry always is for "sound learning." The idea always is that these studies are *safe.*

Vesalius.

At twenty-eight years of age, Vesalius gave to the world his great work on human anatomy. With it ended the old and began the new. Its researches by their thoroughness formed a triumph of science, its illustrations by their fidelity formed a triumph of art. To shield himself as far as possible in the battle which he foresaw must come, Vesalius prefaced the work by a dedication to Emperor Charles V. In this dedicatory preface he argues for his method and against the parrot repetitions of the old medical text-books. He also condemns the wretched anatomical preparations and specimens made by physicians who utterly refused to advance beyond the ancient master. The parrot-like repeaters of Galen gave battle at once. After the manner of their time their first missiles were epithets, and the almost infinite magazine of these having been exhausted, they began to use sharper weapons—weapons theologic. At first the theologic engine did not succeed. A conference of divines having been appealed to to decide dissection of the human body is sacrilege, gave a decision in his favor.

The reason was simple. Emperor Charles V had made Vesalius his physician, and could not spare him. But on the accession of Philip II of Spain the whole scene changed. That most bitter of bigots must, of course, detest the great innovator. A new weapon was now forged. Vesalius was charged with dissecting living men, and either from direct persecution, as the great majority of authorities assert, or from indirect influences, as the few recent apologists for Philip the II allow, Vesalius became a wanderer. On a pilgrimage to the Holy Land to atone for his sin, he is shipwrecked, and in the prime of his life and strength he is lost to this world. And yet not lost. In this century he again stands on earth. That noble painter Hanann has again given him to the world. By the magic of Hanann's pencil we look once more into Vesalius's cell. Its windows and doors, bolted and barred by himself, betoken the storm of bigotry which raged without. The crucifix, toward which he casts his eye, symbolizes the spirit in which he labored. The corpse of the plague stricken over which he bends ceases to be repulsive. His very soul seems to send forth rays from the canvas which strengthen us for the good fight in this age. He was hunted to death by men who conscientiously supposed that he was injuring religion. His poor blind foes destroyed one of religion's greatest apostles. What was his influence on religion? He substituted for repetition by rote of worn out theories of dead men, conscientious and reverent, searching into the works of the living God. He substituted for representations of the human structure, pitiful and unreal, truthful representations, revealing the Creator's power and goodness in every line.

Errors in America.

Warfare of this sort against science seems petty indeed, but it is to be guarded against in Protestant countries not less than Catholic. It breaks out in America not less than in France. I have seen, within this last year, the most perverted statements of words uttered in the lecture rooms of an American university, circulated by excellent men, who, in their eagerness, believed them. I have seen phrases, used in lectures by Christian professors at such an institution, eked out and pieced out with prefixes and affixes, and substitutions and suppositions, until they became monstrous perversions; aud then I have seen them used to prove that scientific education is unsafe, and that an unsectarian institution must be unchristian. Lucklily the world has learned something since the days of Galileo and Vesalius.

Agriculture and Political Economy.

Did time permit, we might go over other battle-fields no less instructive than those we have seen. We might go over the battle-fields of agricultural progress, and note how, by a most curious perversion of a text of Scripture, great masses of the peasantry of Russia were prevented from raising and eating potatoes. We might go over the battle-fields of technology, and note how the introduction of railways into France was declared by an earnest churchman an evidence of the Divine displeasure against country innkeepers, who set meat before their guests on fast days. We might go over the battle-fields of political economy, and note how a too literal interpretation of scriptural text regarding usance wrought fearful injury not only upon the material interests, but upon the moral character of hosts of enterprising and thrifty men.

Geology.

But I shall ask you to only one more of these battle-fields; and I select it because it shows more clearly than any others how Protestant nations, and in our own time, have suffered themselves to be led into the same errors that have wrought injury to religion and science in other times. We will look very briefly at the battle-fields of geology. From the first lispings of investigators in this science there was war. The early sound doctrine was that fossil remains were *lusus naturæ*—freaks of nature; and in 1517 Fracastor was violently attacked because he thought them something more. No less a man than Bernard Palissy followed up the contest, on the right side in France, but it required 150 years to carrry the day fairly against this single preposterous theory. The champion who dealt it the deadly blow was Scilla; and his weapons were facts obtained by examination of the fossils of Calabria (1670). But the advocates of tampering with scientific reasoning soon retired to a new position. It was strong, for it was apparently based on Scripture; though, as the whole world now knows, an utterly exploded interpretation of Scripture. The new position was, that the fossils were produced by the deluge of Noah. In vain had it been shown by such devoted Christians as Bernard Palissy that this theory was utterly untenable; in vain did good men protest against the injury sure to result to religion by tying it to a scientific theory sure to be exploded; the doctrine that the fossils were remains of animals drowned at the flood continued to be upheld by the great majority as "*sound*" doc-

trine. It took 120 years for the searchers of God's truth, as revealed in nature, such men as Buffon, Linnæus, Woodward, and Whitehurst, to run under these mighty fabrics of error, and, by statements which could not be resisted, to explode them.

Strange as it may at first seem, the war on geology was waged more fiercely in Protestant countries than Catholic; and of all countries, England furnished the most bitter opponents. You have noted already that there are generally two sorts of attacks on a new science. First, there is the attack by putting against science some great doctrine in theology. You saw this in astronomy, when Bellarmine and others insisted that the doctrine of the earth's revolving about the sun is contrary to the doctrine of the incarnation. So now against geology it was urged that the scientific doctrine that the fossils represented animals which died before Adam was contrary to the doctrine of Adam's fall, and that death entered the world by sin. Then there is the attack by the literal interpretation of texts, which serves a better purpose generally in rousing prejudice. It is difficult to realize it now; but within the memory of the majority of those before me, the battle was raging most fiercely in England, and both these kinds of artillery were in full play and filling the civilized world with their roar. Less than thirty years ago, the Rev. J. Mellor Brown was hurling at all geologists alike, and especially at such Christian divines as Dr. Buckland, Dean Conybeare, and Pye Smith, and such religious scholars as Professor Sedgwick, the epithets of "Infidel," "Impugner of the Sacred Record," and "Assailant of the Volume of God." His favorite weapon was the charge, that these men were "attacking the Truth of God," forgetting that they were simply opposing the mistaken interpretations of J. Mellor Brown. He declared geology "not a subject of lawful inquiry;" he speaks of it as a "dark art," as "dangerous and disreputable," as a "forbidden province." This attempt to scare men from the science having failed, various other means were taken.

To say nothing about England, it is humiliating to human nature to remember the trials to which the pettiest and narrowest of men subjected such Christian scholars in our country as Benjamin Silliman and Edward Hitchcock. But it is a duty and a pleasure to state here that one great Christian scholar did honor to religion and to himself by standing up for the claims of science despite all these clamors. That man was Nicholas Wiseman, better known afterwards as Cardinal Wiseman. The conduct of this pillar of the Roman Catho-

lic Church contrasts nobly with that of timid Protestants who were filling England with shrieks and denunciations. Perhaps the most singular attempt against geology was that made by a fine specimen of the English Don, Dean Cockburn of York, to *abuse* its champions out of the field. Without apparently the simplest elementary knowledge of geology, he opened a battery of abuse. He gives it to the world at large by pulpit and press; he even inflicts it upon leading statesmen by private letters. But these weapons did not succeed. They were like Chinese gongs and dragon lanterns against rifled cannon. Buckland, Pye Smith, Lyell, Silliman, Hitchcock, Murchison, Agassiz, Dana, and a host of noble champions besides, pressed on the battle for truth was won. And was it won merely for men of science? The whole civilized world declares that it was won for religion; that thereby was infinitely increased the knowledge of the power and goodness of God.

Fears about Religion.

And now, in concluding, I might allude to another battle-field in our own land and time. I might show how an attempt to meet the great want of this State for an institution providing scientific and modern instruction has been met with loud outcries from many excellent men who fear injury thereby to religion. I might picture to you the strategy which has been used to keep earnest young men from an institution which, it is declared, cannot be Christian because it is not sectarian. I might lay before you wonderful lines of argument which have been made to show the dangerous tendencies of a plan which gives to scientific studies the same weight as classical studies, and which lays no less stress on modern history and literature than on ancient history and literature. I might show how it has been denounced from many pulpits, and in many sectarian journals, how the most preposterous charges have been made and believed by good men, how the epithets of "godless," "infidel," "irreligious," "unreligious," "atheistic," have been hurled against a body of Christian trustees and professors earnestly devoted to building up Christian civilization. I might show how, as the battle has waxed hotter, the honored founder of the institution, a man who has devoted the bulk of his fortune and all his efforts to building up such an institution as the State needs, and whose life has been one of the purest and noblest on American records, how the man has been charged with," "swindling the colleges of the State," "self-seeking," "corruption," "seeking to erect a monument to himself."

CHEERFUL OMENS.

But, my friends, I will not weary you with so recent a chapter in the history of the great warfare extending through the centuries. There are cheering omens. The greatest and the best men in the churches—the men standing at centers of thought—are insisting with power, more and more, that religion shall no longer be tied to so injurious a policy—that searchers for truth, whether in theology or natural science, shall work on as friends, sure that, no matter how much at variance they may at times seem to be, the truths they reach shall finally be fused into each other. No one need fear the results. No matter whether science shall complete her demonstration that man has been on the earth six thousand years or six hundred thousand. No matter whether she reveal new ideas of the Creator or startling relations between his creatures—the result, when fully thought out, will serve and strengthen religion not less than science. The very finger of the Almighty has written on history that science must be studied by means proper to itself, and in no other way. That history is before us all. No one can gainsay it. It is decisive, for it is this: There has never been a scientific theory framed from the use of Scriptural texts, which has been made to stand. This fact alone shows that our wonderful volume of sacred literature was not given for any such purpose as that to which so many earnest men have endeavored to wrest it. The power of that volume has been mighty indeed. It has inspired the best deeds our world has known. Despite the crusts which men has formed about it—despite the fetters which they have placed upon it—Christianity has blessed age after age of the past and will go on as a blessing through age after age of the future. Let the warfare of science, then, be changed. Let it be a warfare in which religion and science shall stand together as allies, not against each other as enemies. Let the fight be for truth of every kind against falsehood of every kind—for justice against injustice—for right against wrong—for beauty against deformity—for goodness against vice—and the great warfare which has brought so many sufferings, shall bring to earth God's richest blessings.

SCIENTIFIC LECTURE.—II.

HOW ANIMALS MOVE.

By Professor E. S. Morse.

The second of the series of scientific lectures before the American Institute was delivered last evening at the Cooper Institute, by Prof. E. S. Morse of the Peabody Academy of Science, Salem, Mass. Subject: "How Animals Move." The lecture was illustrated by drawings of the animals, which were rapidly and finely executed upon a blackboard. The President of the Institute, Mr. Horace Greeley, introduced the lecturer who spoke substantially as follows:

Ladies and Gentlemen.—In selecting this subject for a lecture, I had a two-fold object in view. To compass within the limits of a single lecture a rapid sketch of the animal kingdom, and to illustrate from the examples cited a new principle of classification. The great thinking class desire principles. They demand the results of scientific investigation. They have no desire to know the number of petals in a flower, or the number of segments in an insect, and while this work must be done, and patient inquirers there be who are continually adding the minutiæ to the science, the public are only interested in the deductions drawn from this maze of facts. In the classification of animals we shall find principles that give us a clue to the relative superiority of an animal, and while there is no question about the highest animal in existence, or certain forms which are known to be the lowest, the hundreds of thousands of intermediate forms are to be classified and arranged in a natural sequence. The relations among animals may be shown by their structural resemblances, but the relative grade of animals is shown not only by the greater complication of their structure, but also by certain principles which I will illustrate. A principle, first enunciated by Prof. Agassiz, is that animals which are aquatic in their habits (in their respective groups) are inferior to those which are terrestrial or ærial.

Thus the lowest group in the animal kingdom, the protozoa are all aquatic. Two next lowest branch, the radiata are all aquatic; mollusca comes next, and with few exceptions, *e. g.*, the land snails are all aquatic, and even these occupy damp and wet places as a necessity of their existence. In the next branch, the articulates, while its highest class, the insects are terrestrial, or ærial, the two lowest classes the worms and crustacea, with few exceptions are aquatic. Now if we consider the vertebrata, we shall find its lowest class, the fishes, are all aquatic. The batrachians are amphibious and aquatic. The reptiles have certain groups that are aquatic, and though the two highest classes of the vertebrates, the birds and mammals, are terrestrial, yet, their lowest forms, the auks, of the birds, and the whales, and dolphins, of the mammals, are aquatic.

Another principle of far more special application is that based upon embryological data. It has been found that animals, in their development, pass through certain stages that recall the adult conditions of animals below them. A common example may be cited among the batrachians, where the lowest forms resemble fishes having tufts of gills on the sides of the neck and a long finned tail. A little higher up, we come to those that have the same general form, but the gills are wanting, and they breathe air. The toads and frogs are the highest, and here the tail is absent, and now locomotion is performed by the strongly developed hind legs. If we now examine the development of any frog, it will be found that, on leaving the egg, the animal is without legs, and swims with its tail, and breathes by gills; that by successive steps it becomes an air-breather, little legs bud out, and ultimately the tail is absorbed, and we have the completed animal. You will see by these figures that the different stages resemble some of the forms I have just drawn. Many other examples might be cited, but time will not allow me to present them.

This principle has been recognized under a variety of propositions by many minds. Goethe, in 1807, and Von Baer in 1828, showed that development was always from the general to the special, from the homogeneous to the heterogeneous, from the simple to the complex, and this by a gradual series of differentiation, and Herbert Spenser has applied the same law of evolution in many new and startling ways. And as a law of evolution, it is interesting to notice that in the advent of animal life upon earth we have a sequence of forms that illustrate the fact that the earlier forms created within

their respective groups were also the lowest. Agassiz has beautifully illustrated this among the edimoderms and fishes; the earliest fishes had tails, in which the vertebral column terminated in the upper lobe of the caudal fin, like the sharks; while fishes of higher structure have the vertebral column terminating at the root of the caudal fin. Yet, if you will examine a young trout, just hatched, you will see that the tail resembles that of the shark in this feature.

In order to illustrate another principle of classification, I will first make you acquainted with some of the various modes of locomotion in the animal kingdom, and first and lowest of all is the locomotive egg. Among many of the lower animals, the egg is supplied with cilia, by which it is carried through the water and assists in its wider dissemination. Among the lower plants the same feature is recognized, and the spores of many sea weed are propelled through the water by means of this primitive, though effective apparatus. (These cilia are like little membraneous hairs that thickly clothe the exterior of the body, and by their rapid vibration urge it through the water. They are microscopic.) We may rightly conclude that ciliary motion is the lowest mode of propulsion of an animals, and so find that among the protozoa this mode is conspicuous. I need only to delineate a few of the infusoria so common in stagnant water to indicate this feature. Now, while these low forms depend upon the presence of cilia to propel them, a little higher in the scale the same peculiar ciliary membrane assists only in exciting currents of water to flow to the mouth, whereby particles of food are brought within its reach, or within its stomach and intestine; the nutritive matter is circulated by the same means.

Another form of locomotion is seen in the amœba, one of the simplest of animals. The body has no stomach, no locomotive organs, in fact we might say has no organization, resembling more a drop of thin glue than anything else, and yet this little animal can move, and can ingest and digest food. It moves by certain portions of its body expanding or projecting, and then the remaining portions contracting to it. And while it is dragging itself along it may at any time engulf in its folds particles of food, which are rapidly digested, and any portion of its body may at any time improvise a temporary stomach. In other members of this simple group the animal fabricates a beautiful shell of microscopic proportions, though of such remarkable structure and singular resemblance to the nautilus and ammonite that for a long

time the best naturalists included them in the same class. On further study it was shown that the softer portions of this animal were of the utmost simplicity, that the little chambers of the shell were filled with a substance almost homogeneous, and resembling the amœbæ, and that this matter could be projected in fine threads through the many holes which ornamented the shell, performing locomotive acts and combining together to form simple stomachs. This little chambered shell is also filled with some simple substance which projects in fine threads through the many minute perforations of the shell, and performs the act of locomotion and digestion as in amœba.

Another condition peculiar to many animals is their fixed condition. In all the branches except the vertebrates, members are found which have no power of locomotion, always adhering to some substance. Many of the lowest animals, like the sponge, are fixed, growing in communities, like the coral builders. The crinoids, or stemmed star-fishes, are attached by a stem to the rock. Many of the lower shell-fish, and certain low worms and the barnacles are always fixed, though many of these, in their younger stages, are locomotive animals, as the barnacle, for example, which, upon issuing from the egg, remotely resembles the young of the crab and lobster, is furnished with eyes and skips about in the water for some time. Afterward it becomes affixed, head downward, to the rock, or whatever appropriate substance it may meet with, and becomes stationary for life. Many of these fixed animals are parasitic on other species; the whale being oftentimes covered with a peculiar barnacle; and other animals might be mentioned which are likewise parasitic; then there are certain species which become attached to floating timbers or to sea weed, and even the bottoms of vessels are frequently so thickly covered with species of this nature as to materially retard their speed. In other cases only the early condition of certain animals are attached, as in the discoid jelly fishes, the young is rooted to some spot, and reminds one of the polyps, to which group they were at first referred; by successive divisions of this unit, a number of little jelly fishes are produced. This attached condition of animals may be called a vegetative character, and is a sign of degradation, and we find only the lowest forms of certain groups attached.

Another form of locomotion is seen in certain animals where a large portion of the body is formed into a creeping disk. [The lecturer then rapidly illustrated, on the board, various worms, snails, &c.] The sea anemone has slight powers of locomotion through a

net work of muscular fibers furnishing the broad area by which they adhere. Most bivalves and snails have a more specialized apparatus called the "foot," by which they creep along. A singular feature among some is the power the foot has of imbibing water; and on examination there are found to be a series of channels for this express purpose. Let any one take up the common beach cockle (Natica), when it is crawling over the sand, and he will see how slowly the foot gradually contracts, and draws within the shell, the water which had previous been absorbed slowly oozing from it.

In another phrase we have the animals swimming through the water by hydrodnamic action; thus, in the discoid jelly fishes, the water is urged from beneath the water by expansions and contractions of the disk. In some low forms of mollusks, *e. g.*, salpa, the body dilates, drawing in water at one opening, and then, by vigorous contraction, expelling it from another opening, and the resistance offered propelling the body. In a similar manner the common scallop, by rapid opening and closing its two shells forces the body along.

The squid, or cuttle fish, among its various modes of locomotion, has the same power of ejecting jets of water, and swimming in this way; and the pointed extremity of its body is well adapted to cleave the water. The paper nautilus was for a long time supposed to possess the power of floating on the surface of the water, using its long arms for oars, and its other two arms thrown aloft and spread, as sails to catch the breeze. This beautiful story is not true, however, and the paper nautilus moves as all other cuttle fishes move, having no power to come to the surface. Thus far, we have seen movements by ciliary action, as in the infusoria, and also movements of the animal wherein nearly the whole body was involved in effort. Now we are to consider animals in which the locomotive organs become more specialized. In a large group of jelly fishes the body is provided externally with bands composed of many vibrating paddles, in their movements looking very much like cilia; and these cause the body to rotate, or move in a straight line. Among the star fishes we find channels on the under side of the animal, which give rise to a great number of little suckers, looking like so many little writhing worms. Our common star fish has from 1,500 to 2,000 of these suckers. They are projected like legs, and drag the body slowly along.

The cuttle fish, also, has arms furnished with suckers, but, unlike the star fish, the suckers simply hold the arms, so that they can find points of support in their movements.

The hydra moves by its tentacles, and sucker-like extremity. Many marine worms are provided with a series of little paddles, and by their movements the animal is enabled to swim gracefully in the water.

Among the crustacea, it is very instructive to examine the functions performed by appendages strangely modified to perform various functions.

In the incipient stages of the lobster, for example, the body is composed of a series of rings, with appendages quite identical in shape and size. In its growth the forward rings unite above and form the carapace or shield, while in the hinder portion of the body the rings remain separated so as to give full play to its movements. It is by this portion that the lobster leaps backward in the water. Beneath this portion are found little appendages that are flattened, and form natatory organs by which they can swim. These appendages are also covered with hairs, and to these the eggs adhere when discharged by the parent. The small claws are jointed, and are used as legs by which they crawl, the two hinder pairs of claws having but one projecting point, while the two forward pair of small claws have a little pincer or nipper at the end. An examination will show that no new feature is added to the claw, but simply an excess in the growth of a portion of it, by which an opposing point is made. The large claws are only an accessive development of a similar appendage. Even the numerous organs around the mouth, the feelers and eyes, are but modified feet.

In insects we have for the first time animals that support themselves by wings, those having broad wings like the butterfly, moving them slowly, while the bee, with small wings, moving them with incredible velocity. Time will again compel me to neglect the special features in this group. We at last come to the vertebrates, as the highest branch, and here the locomotive organs are reduced to two pairs. In the lowest class, the fishes, these appendages are represented by the pectoral and ventral fins, and have little to do with the propulsion of the animal. This is accomplished by the broad fin on the tail, which is rapidly moved from side to side, as a man in sculling moves his oar. In the flying fish, the fins that represent the fore legs are greatly enlarged, and enable the fish to take short flight in the air; while in another fish the same fins are developed into rude legs, by which they creep over the mud. In the flounder a curious modification takes place in the structure of the head. When first

hatched from the egg, the flounder swims as other fishes swim, with the back uppermost. Soon, however, the eye upon one side of the head slowly changes its position, and actually passes through the skull and comes out by the side of the other eye. The flounder then rests upon one side which is white, or lighter in color than that side which is turned toward the light. Among the batrachians the limbs are modified to accord with their respective habits. In some the merest rudiments are present. In the water newts the tail is long and has a membraneous fin running along its upper and lower edge, and the tail is swung back and forth, as in the fishes. In others, the hind legs are enormously developed, the toes being webbed, and are used for swimming and jumping.

Snakes.

Among the reptiles we have some singular modifications in their locomotive apparatus, thus in the snakes we have a long cylindrical body with the fore and hind limbs absent (except the rudiments of hind legs in the boa), and yet, despite this deprivation, the snake can move rapidly over the ground, can swim gracefully, can leap in the air and climb trees, and, in short, can perform almost every mode of locomotion except flying. We shall find upon examination that each pair of ribs is connected with one of the ventral scales, the face edge of which projects backward. These scales lap one over the other, and the ribs, in swinging back and forth, also move the scales whose sharp edges catch in the ground, and thus the body is impelled forward. It will be remembered that a snake moves with difficulty on a smooth surface, it is because the scales have no projections upon which to catch.

Among the turtles, while many are adapted to crawl upon the land and have proper fore and hind legs, among the sea turtles, these legs are changed to fins, and in one species, found rarely on our coast (Phargis Coriacea), the lecturer had made drawings of one whose forward fins measured eleven feet from tip to tip.

In the birds we have various modifications of the wings and legs, suited to their different habits. The birds as a class, form the most distinct groups in the animal kingdom. No one ever mistook a bird; while naturalists at one time regarded the whale as a fish, and corals as plants, and barnacles as mollusks. No one has ever mistaken a bird for any other animal. The characters of any one bird stand for the whole class, they are all warm blooded, all breathe air, all are

oviparous and edentulous, having always two legs and two wings, clothed with feathers, and having the jaws protected by a horny sheath, and yet in some species the wing is rudimentary and actually resembles the fin or flipper of a turtle, and is used by certain birds in swimming.

The narrow limits of a single lecture will not allow us to dwell on the many singular modifications of the hind limbs of birds, nor can we spend the time we would like on the locomotive appendages of the mammalia, though we must allude to the whale as a low mammal, in which the hind legs are rudimentary or wanting, and the fore legs are changed to fins or flippers. The tail having broad, lateral fins, and the animal moving that portion of the body in a vertical direction, and not from side to side as in the fish.

At the commencement of the lecture we referred to another principle of classification we were to illustrate, and this is the principle of cephalization, first enunciated by an American naturalist, Prof. J. D. Dana of Yale college. As Prof. Dana says, the importance of a head to an animal all understand, and it makes all the difference between the typical animal, and the typical plant. An animal may be called a fore-and-aft structure, while the plant is an up-and-down structure. The animal has more or less will emanating from the head producing voluntary motion, and an animal is typically a forward-moving or a go-head being, while a plant simply stands and grows. An animal however simple, knows enough to steer clear of obstacles, in its movements, or attempts to, at least, while a plant is utterly a non-percipient, unknowing thing.

As the head is the seat of power in an animal, it is natural, that, as the body more or less contributes by its members to the purposes of the head, so we should have relative grade or standing clearly indicated. "Cephalization is then simply the degrees of head dominion in the structure."

It is evident that animals which are fixed or attached through life to one spot, represent a vegetative condition, and also that in those animals in which the head is not clearly manifested, as in the jelly fishes and star fishes, where the mouth is apparently in the center of the body, and the parts surround the mouth equally, that here we have a low phase of life. Among the shell fish, or mollusca, we have a head apparent for the first time. Let us now examine this branch, and we shall find that among the lowest members the head is barely indicated, while in the highest members the head is strongly specialized.

Thus in the clams and mussels, as common examples, we have a fleshy expansion called the "foot," and this is simply an organ of locomotion. The head is not developed, only a mouth, which has no power of seizing food, and this part has no power of projecting beyond the edges of the bivalve shell that protects it. In the snails we have a more specialized creeping disk or foot, and now the mouth can be protruded from the shell, and the creeping disk is not only used for locomotion, but for prehension, as in the beach cockle (natica) for example. This has the power of seizing their prey and holding it, while the mouth, now armed with special hard parts for biting and rasping, can readily reduce its food. In the highest members of the mollusca (cuttle fishes, squids) the same creeping disk is highly specialized into long arms furnished with suckers, and now we find the head possessing a pair of highly organized eyes, and the mouth armed with two parrot-like beaks, and also the so-called tongue for rasping its food. Thus we have in the lowest class simply locomotion, in the next class locomotion and prehension, and in the highest class locomotion, prehension and aggression, for the cuttle fish is an aggressive animal, and with its long arms can seize fishes of large size.

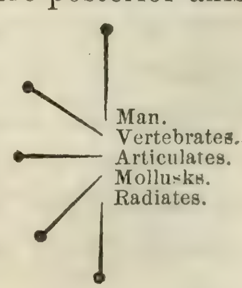
If we now turn to the articulates we shall find the principle of cephalization well illustrated in the relative rank of the classes. Thus in the lowest class, the worms, the body is made up of a series of rings identical in shape and structure. In the next class, the crustacea, the number of segments or rings composing the body is less, and now a specialization of junction is manifested by some of the rings toward the head; for example, there is one group of crustaceans in which the members of the group have seven pair of legs and four pair of mouth organs or jaws. The group next above, comprising the highest crustacea, such as the lobster and crab, have only five pair of legs and seven pair of mouth organs, thus while the body has lost two pair of legs the head has gained two pair of legs, simply by the conversion of the locomotive organs to a higher and more special use.

If we run up in the articulates we shall find that the locomotive appendages are reduced in number, in the spiders only four pair of legs are seen, and in the insects, the highest class in the articulates, only three pair of legs are present, and now the body is so highly specialized that the head is highly specialized, also; the thorax is separated from the hinder division of the body, and called the abdomen.

If we now look at the vertebrates, we shall find the locomotive

organs reduced to two pairs; in the lowest class, the fishes, these are represented by simple fins, and assist but little in locomotion, this act being performed by the tail. In the reptiles legs first appear. In the birds the fore legs are specialized and converted into wings. Among the mammalia the lowest members again recall the fishes in the reduction of the fore legs to fin like organs, and the head is enormously prolonged beyond the brain, which occupies a small cavity. Taking only the more prominent groups, we see in the herbivorous animals the legs used simply for locomotion, the head degraded to purposes of self-defence, and generally armed with prominent horns. In the carnivorous animals the fore legs now aid in securing their food as well as performing the act of locomotion. In the monkeys the fore legs not only perform the act of locomotion, but also convey food to the mouth, and hold the young to their breast in nursing. In man, the highest vertebrate, the fore legs are removed entirely from the locomotive series, and become subservient to the head. It is interesting to review the relative attitude of the different animals in their relation to the world; thus the lowest radiates are rooted to one spot, and in this respect represent a vegetative character; in the other members of this branch they move head downward as in the jelly fishes and star fishes. In the next branch, the mollusca, the lowest members are buried head downward in the mud. In the snails the head is generally below the bulk of their body. In the cuttle fishes the head is on a level with their body, or in other words, the antero-posterior axis is horizontal while swimming, but in crawling the head is below, and a mean line representing the antero-posterior axis for the branch, would be on an angle of forty-five degrees, the head downward.

In the articulates the antero-posterior axis is horizontal. Of the vertebrates, the fishes are horizontal, and in the reptiles the head becomes slightly elevated, while in the birds and mammals the head is still more elevated, so that a mean line representing the antero-posterior axis for all the vertebrates not including man, would be at an angle of forty-five degrees, the head above. And in man, as we have just shown, this line is verticle, the head uppermost. Thus the following diagram would represent the relative position of the antero-posterior axis for the various branches, the knob at the end of the line indicating the head.



The lecturer closed by quoting from Agassiz: "Man is the crown-

ing work of God on earth; but though so nobly endowed, we must not forget that we are the lofty children of a race whose lowest forms lie prostrate within the water, having no higher aspiration than the desire for food; and we cannot understand the possible degradation and moral wretchedness of man, without knowing that his physical nature is rooted in all the material characteristics that belong to his type and link him even with the fish. The moral and intellectual gifts that distinguish him from them are his to use or abuse; he may, if he will, abjure his better nature and be vertebrate more than man. He may sink as low as the lowest of his type, or he may rise to a spiritual height that will make those which distinguish him from the rest far more the controlling element of his being than that which unites him with them."

SCIENTIFIC LECTURE---III.

THE CORRELATION OF VITAL AND PHYSICAL FORCES.

BY PROF. GEORGE F. BARKER, M. D., OF YALE COLLEGE.

Dr. Barker delivered the third of this winter's course of scientific lectures before the American Institute. The lecture was illustrated by various experiments with philosophical apparatus, and was attentively listened to throughout. Horace Greeley, President of the Institute, introduced the lecturer, who spoke as follows :

In the Syracusan Poecile, says Alexander von Humboldt in his beautiful little allegory of the Rhodian Genius, hung a painting which, for full a century, had continued to attract the attention of every visitor. In the foreground of this picture a numerous company of youths and maidens of earthly and sensuous appearance gazed fixedly upon a hallowed Genius who hovered in their midst. A butterfly rested upon his shoulder, and he held in his hand a flaming torch. His every lineament bespoke a celestial origin. The attempts to solve the enigma of this painting—whose origin even was unknown—though numerous, were all in vain, when one day a ship arriving from Rhodes, laden with works of art, brought another picture, at once recognized as its companion. As before, the Genius stood in the center, but the butterfly had disappeared and the torch was reversed and extinguished. The youths and maidens were no longer sad and submissive, their mutual embraces announcing their entire emancipation from restraint. Still unable to solve the riddle, Dionysius sent the pictures to the Pythagorean sage, Epicharmus. After gazing upon them long and earnestly, he said : Sixty years long have I pondered on the internal springs of nature, and on the differences inherent in matter ; but it is only this day that the Rhodian Genius has taught me to see clearly that which before I had only conjectured. In inanimate nature, everything seeks its like. Everything, as soon as formed, hastens to enter into new combinations, and nought save the

disjoining art of man can present in a separate state ingredients which ye would vainly seek in the interior of the earth or in the moving oceans of air and water. Different, however, is the blending of the same substances in animal and vegetable bodies. Here vital force imperatively asserts its rights, and heedless of the affinity and antagonism of the atoms, unites substances which in inanimate nature ever flee from each other, and separates that which is incessantly striving to unite. Recognize, therefore, in the Rhodian, Genius, in the expression of his youthful vigor, in the butterfly on his shoulder, in the commanding glance of his eye, the symbol of vital force as it animates every germ of organic creation. The earthly elements at his feet are striving to gratifiy their own desires and to mingle with one another. Imperiously the Genius threatens them with upraised and high-flaming torch, and compels them, regardless of their ancient rights, to obey his laws. Look now on the new work of art; turn from life to death. The butterfly has soared upward, the extinguished torch is reversed, and the head of the youth is drooping; the spirit has fled to other spheres, and the vital force is extinct. Now the youths and maidens join their hands in joyous accord. Earthly matter again resumes its rights. Released from all bonds, they impetuously follow their natural instincts, and the day of his death is to them a day of nuptials.*

The view here put by Humboldt into the mouth of Epicharmus may be taken as a fair representation of the current opinion of all ages concerning vital force. To-day, as truly as seventy-five years ago when Humboldt wrote, the mysterious and awful phenomena of life are commonly attributed to some controlling agent residing in the organism; to some independent presiding deity, holding it in absolute subjection. Such a notion it was which prompted Heraclitus to talk of a universal fire, Van Helmont to propose his Archæus, Hofmann his vital fluid, Hunter his *materia vitæ diffusa*, and Humboldt his vital force.† All these names assume the existence of a

* Humboldt, Views of Nature, Bohn's ed., London, 1850, p. 380. This allegory did not appear in the first edition of the Views of Nature. In the preface to the second edition the author gives the following account of its origin: "Schiller," he says, "in remembrance of his youthful medical studies, loved to converse with me, during my long stay at Jena, on physiological subjects." * * * * "It was at this period that I wrote the little allegory on vital force, called The Rhodian Genius. The predilection which Schiller entertained for this piece, which he admitted into his periodical, *Die Horen*, gave me courage to introduce it here," It was published in *Die Horen* in 1795.

† Humboldt, *op. cit.*, p. 386 In his *Aphorismi ex doctrina Physiologiæ chemicæ Plantarum*, appended to his *Flora Fribergensis subterranea*, published in 1793, Humboldt had said "Vim internam, quæ chymicæ affinitatis vincula resolvit, atque obstat, quominus elementa corporum libere conjungantur, vitalem vocamus." "That internal force, which dissolves the bonds of chemical

material or immaterial something, more or less separable from the material body, and more or less identical with the mind or soul, which is the cause of the phenomena of living beings. But as science moved irresistibly onward, and it became evident that the forces of inorganic nature were neither deities nor imponderable fluids, separable from matter, but were simple affections of it, analogy demanded a like concession in behalf of vital force.* From the notion that the effects of heat were due to an imponderable fluid called caloric, discovery passed to the conviction that heat was but a motion of material particles, and hence inseparable from matter. To a like assumption concerning vitality it was now but a step. The more advanced thinkers in science of to-day, therefore, look upon the life of the living form as inseparable from its substance, and believe that the former is purely phenomenal, and only a manifestation of the latter. Denying the existence of a special vital force as such, they retain the term only to express the sum of the phenomena of living beings.

In calling your attention this evening to the correlation of the physical and the vital forces, I have a twofold object in view. On the one hand, I would seek to interest you in a comparatively recent discovery of science, and one which is destined to play a most important part in promoting man's welfare; and on the other, I would inquire what part our own country has had in these discoveries.

In the first place, then, let us consider what the evidences are that vital and physical forces are correlated. Let us inquire how far inorganic and organic forces may be considered mutually convertible, and hence, in so far, mutually identical. This may best be done by considering, first, what is to be understood by correlation; and, second, how far are the physical forces themselves correlated to each other.

At the outset of our discussion, we are met by an unfortunate ambiguity of language. The word force, as commonly used, has

affinity, and prevents the elements of bodies from freely uniting, we call vital." But in a note to the allegory above mentioned, added to the third edition of the Views of Nature, in 1849, he says: "Reflection and prolonged study in the departments of physiology and chemistry have deeply shaken my earlier belief in peculiar so-called vital forces. In the year 1797, * * * I already declared that I by no means regarded the existence of these peculiar vital forces as established." And again: "The difficulty of satisfactorily referring the vital phenomena of the organism to physical and chemical laws depends chiefly (and almost in the same manner as the prediction of meteorological processes in the atmosphere) on the complication of the phenomena, and on the great number of the simultaneously acting forces as well as the conditions of their activity."

* Compare Henry Bence Jones' Croonian Lectures on Matter and Force. London, 1868, John Churchill & Sons.

three distinct meanings. In the first place, it is used to express the cause of motion, as when we speak of the force of gunpowder; it is also used to indicate motion itself, as when we refer to the force of a moving cannon ball; and, lastly, it is employed to express the effect of motion, as when we speak of the blow which the moving body gives.* Because of this confusion, it has been found convenient to adopt Rankine's suggestion,† and to substitute the word "energy" therefor. And precisely as all force upon the earth's surface, using the term force in widest sense, may be divided into attraction and motion, so all energy is divided into potential and actual energy, synonymous with those terms. It is the chemical attraction of the atoms, or their potential energy, which makes gunpowder so powerful; it is the attraction or potential energy of gravitation which gives the power to a raised weight. If, now, the impediments be removed, the power just now latent becomes active, attraction is converted into motion, potential into actual energy, and the desired effect is accomplished. The energy of gunpowder or of a raised weight is potential, is capable of acting; that of exploding gunpowder or of a falling weight is actual energy or motion. By applying a match to the gunpowder, by cutting the string which sustains the weight, we convert potential into actual energy. By potential energy, therefore, is meant attraction; and by actual energy, motion. It is in the latter sense that we shall use the word force in this lecture; and we shall speak of the forces of heat, light, electricity and mechanical motion, and of the attractions of gravitation, cohesion, chemism.

From what has now been said, it is obvious that when we speak of the forces of heat, light, electricity or motion, we mean simply the different modes of motion called by these names. And when we say that they are correlated to each other, we mean simply that the mode of motion called heat, light, electricity, is convertible into any of the others, at pleasure. Correlation therefore implies convertibility, and mutual dependence and relationship.

Having now defined the use of the term force, and shown that forces are correlated which are convertible and mutually dependent, we go on to study the evidences of such correlation among the motions of inorganic nature usually called physical forces; and to

* Ib., preface, p. vi.

† Rankine, W. J. M., Philosophical Magazine, Feb., 1853. Also Edinburgh Philosophical Journal, July, 1855.

ask what proof science can furnish us that mechanical motion, heat, light, and electricity are thus mutually convertible. As we have already hinted, the time was when these forces were believed to be various kinds of imponderable matter, and chemists and physicists talked of the union of iron with caloric as they talked of its union with sulphur, regarding the caloric as much a distinct and inconvertible entity as the iron and sulphur themselves. Gradually, however, the idea of the indestructibility of matter extended itself to force. And as it was believed that no material particle could ever be lost, so, it was argued, no portion of the force existing in nature can disappear. Hence arose the idea of the indestructibility of force. But, of course, it was quite impossible to stop here. If force cannot be lost, the question at once arises, what becomes of it when it passes beyond our recognition? This question led to experiment, and out of experiment came the great fact of force-correlation; a fact which distinguished authority has pronounced the most important discovery of the present century.* These experiments distinctly proved that when any one of these forces disappeared, another took its place; that when motion was arrested, for example, heat, light or electricity was developed. In short, that these forces were so intimately related or correlated, to use the word then proposed by Mr. Grove,† that when one of them vanished, it did so only to reappear in terms of another. But one step more was necessary to complete this magnificent theory. What can produce motion but motion itself? Into what can motion be converted, but motion? May not these forces, thus mutually convertible, be simply different modes of motion of the molecules of matter, precisely as mechanical motion is a motion of its mass? Thus was born the dynamic theory of force, first brought out in any completeness by Mr. Grove, in 1842, in a lecture on the "Progress of Physical Science," delivered at the London Institution. In that lecture he said: "Light, heat, electricity, magnetism, motion, are all convertible material affections. Assuming either as the cause, one of the others will be the effect. Thus heat may be said to produce electricity, electricity to produce heat; magnetism to produce electricity, electricity magnetism; and so of the rest."‡

* Armstrong, Sir Wm. In his address as President of the British Association for the Advancement of Science. Rep. Brit. Assoc., 1863, li.

† Grove, W. R., in 1842. Compare "Nature" i, 335, Jan. 27, 1870. Also *Appleton's Journal*, iii, 324, March 19, 1870.

‡ Id., in Preface to the Correlation of Physical Forces, 4th ed. Reprinted in the Correlation and Conservation of Forces, edited by E. L. Youmans, p. 7. New York, 1865. D. Appleton & Co.

A few simple experiments will help us to fix in our minds the great fact of the convertibility of force. Starting with actual visible motion, correlation requires that when it disappears as motion, it should reappear as heat, light, or electricity. If the moving body be elastic like this rubber ball, then its motion is not destroyed when it strikes, but is only changed in direction. But if it be non-elastic, like this ball of lead, then it does not rebound ; its motion is converted into heat. The motion of this sledge-hammer, for example, which if received upon this anvil would be simply changed in direction, if allowed to fall upon this bar of lead, is converted into heat; the evidence of which is that a piece of phosphorus placed upon the lead is at once inflamed. So too, if motion be arrested by the cushion of air in this cylinder, the heat evolved fires the tinder carried in the plunger. But it is not necessary that the arrest of motion should be sudden ; it may be gradual, as in the case of friction. If this cylinder containing water or alcohol be caused to revolve rapidly between the two sides of this wooden rubber, the heat due to the arrested motion will raise the temperature of the liquid to the boiling point, and the cork will be expelled. But motion may also be converted into electricity. Indeed electricity is always the result of friction between heterogeneous particles.* When this piece of hard rubber, for example, is rubbed with the fur of a cat, it is at once electrified ; and now if it be caused to communicate a portion of its charge to this glass plate, to which, at the same time, we add the mechanical motion of rotation, the strong sparks produced give evidence of the conversion.

So, too, taking heat as the initial force, motion, light, electricity may be produced. In every steam engine the steam which leaves the cylinder is cooler than that which entered it, and cooler by exactly the amount of work done. The motion of the piston's mass is precisely that lost by the steam molecules which batter against it. The conversion of heat into electricity, too, is also easily effected. When the junction of two metals is heated, electricity is developed. If the two metals be bismuth and antimony, as represented in this diagram, the currents flow as indicated by the arrows ; and by multiplying the number of pairs, the effect may be proportionately increased. Such an arrangement, called a thermo-electric battery, we have here ; and by it the heat of a single gas burner may be made to move, when converted, this little electric bell engine. More-

* Id., ib., Am. ed., p. 33, et seq.

over, heat and light have the very closest analogy; exalt the rapidity with which the molecules move and light appears, the difference being only one of intensity.

Again, if electricity be our starting point, we may accomplish its conversion into the other forces. Heat results whenever its passage is interrupted or resisted; a wire of the poorly conducting metal platinum becoming even red hot by the converted electricity. To produce light, of course, we need only to intensify this action; the brightest artificial light known, results from a direct conversion of electricity.

Enough has now been said to establish our point. What is to be particularly observed of these pieces of apparatus is that they are machines especially designed for the conversion of some one force into another. And we expect of them only that conversion. We pass on to consider for a moment the quantitative relations of this mutual convertibility. We notice, in the first place, that in all cases save one, the conversion is not perfect, a part of the force used not being utilized, on the one hand, and on the other, other forces making their appearance simultaneously. While, for example, the conversion of motion into heat is quite complete, the inverse conversion is not at all so. And on the other hand, when motion is converted into electricity, a part of it appears as heat. This simultaneous production of many forces is well illustrated by our little bell engine, which converts the electricity of the thermo-battery into magnetism, and this into motion, a part of which expends itself as sound. For these reasons the question "How much?" is one not easily answered in all cases. The best known of these relations is that between motion and heat, which was first established by Mr. Joule in 1849, after seven years of patient investigation.* The apparatus which he used is shown in the diagram. It consists of a cylindrical box of metal, through the cover of which passes a shaft, carrying upon its lower end a set of paddles, immersed in water within the box, and upon its upper portion a drum, on which are wound two cords, which, passing in opposite directions, run over pulleys, and are attached to known weights. The temperature of the water within the box being carefully noted, the weights are then allowed to fall a certain number of times, of course in their fall turning the paddles against the friction of the liquid. At the close of the experiment the water is found to be warmer than before. And by measuring the amount of this rise

* Joule, J. P., Philosophical Transactions, 1850, p. 61.

in temperature, knowing the distance through which the weights have fallen, it is easy to calculate the quantity of heat which corresponds to a given amount of motion. In this way, and as a mean of a large number of experiments, Mr. Joule found that the amount of mass motion in a body weighing one pound, which had fallen from a height of 772 feet, was exactly equal to the molecular motion which must be added to a pound of water, in order to heat it one degree Fahrenheit. If we call the actual energy of a body weighing one pound which has fallen one foot, a foot pound, then we may speak of the mechanical equivalent of heat as being 772 foot pounds.

The significance and value of this numerical constant will appear more clearly if we apply it to the solution of one or two simple problems. During the recent war two immense iron guns were cast in Pittsburgh, whose weight was nearly 112,000 pounds each, and which had a caliber of twenty inches.* Upon this diagram is a calculation of the effective blow which the solid shot of such a gun, assuming its weight to be 1,000 pounds, and its velocity 1,100 feet per second, would give; it is 902,797 tons! † Now, if it were possible to convert the whole of this enormous mechanical power into heat, to how much would it correspond? This question may be answered by the aid of the mechanical equivalent of heat; here is the calculation, from which we see that when seventeen gallons of ice cold water are heated to the boiling point, as much energy is communicated as is contained in the death-dealing missile at its highest velocity.‡

* See American Journal of Science, II., xxxvii., 296, 1864.

† The work (W) done by a moving body is commonly expressed by the formula W=MV2, in which M, or the mass of the body, is equal to $\frac{W}{2g}$; *i. e.*, to the weight divided by twice the intensity of gravity. The work done by our cannon ball then would be $\frac{1 \times (1100)2}{2 \times 64\frac{1}{3}}$=9,404.14 foot tons. If, further, we assume the resisting body to be of such a character as to bring the ball to rest in moving ¼ of an inch, then the final pressure would be 9,404.14X12X4=451,398.7 tons. But since, "in the case of a perfectly elastic body, or of a resistance proportional to the advance of the center of gravity of the impinging body from the point at which contact first takes place, the final pressure (provided the body struck is perfectly rigid) is double what would occur were the stoppage to occur at the end of a corresponding advance against a uniform resistance," this result must be multiplied by two; and we get (451,398.7X2) 902,797 tons as the crushing pressure of the ball under these conditions. [The author's thanks are due to his friends, Pres. F. A. P. Barnard and Mr. A. N. Skinner, for suggestions on the relation of impact to statical pressure.]

‡ The unit of impact being that given by a body weighing one pound and moving one foot a second, the impact of such a body falling from a height of 772 feet—the velocity acquired being 222¼ feet per second ($=\sqrt{2sg}$) would be $1 \times (222\frac{1}{4})^2$=49,408 units, the equivalent in impact of one heat unit. A cannon ball weighing 1,000 pounds, and moving 1,100 feet a second, would have an impact of $(1100)^2 \times 100$=1,210,000,000 units. Dividing this by 49,408, the quotient is 24489 heat-units, the equivalent of the impact. The specific heat of iron being ·1138, this amount of heat would raise the temperature of one pound of iron 215,191° F. (24,489X·1138) or of 1000 pounds of iron 215° F. 24489 pounds of water heated one degree, is equal to 136½ pounds, or 17 gallons U. S., heated 180°; *i. e.*, from 32° to 212° F.

Again, if we take the impact of a larger cannon ball, our earth, which is whirling through space with a velocity of nineteen miles a second, we find it to be 98,416,136,000,000,000,000,000,000,000 tons!* Were this energy all converted into heat, it would equal that produced by the combustion of fourteen earths of solid coal.†

The conversion of heat into motion, however, as already stated, is not as perfect. The best steam engines economize only one-twentieth of the heat of the fuel.‡

Hence if a steamship require 600 tons of coal to carry her across the Atlantic, 570 tons will be expended in heating the waters of the ocean, the heat of the remaining thirty tons only being converted into work.

One other quantitive determination of force has also been made. Prof. Julius Thomsen, of Copenhagen, has fixed experimentally the mechanical equivalent of light.§ He finds that the energy of the light of a spermaceti candle burning 126½ grains per hour, is equal in mechanical value to 13.1 foot-pounds per minute. The same conclusion has been reached by Mr. Farmer, of Boston, from different data.¶

If we pass from the actual physical energies of motions to consider, for a moment, the potential energies or attractions, we find, also, an intimate correlation. Since all energy not active in motion is potential in attraction, it follows that in the attractions we have energy stored up for subsequent use. The sun is thus storing up energy; every minute it raises 2,000,000,000 tons of water to the mean height of the clouds, 3½ miles; and the actual energy set free when this water falls is equal to 2,757,000,000,000 horse powers.‖

* Assuming the density of the earth to be 5·5, its weight would be 6,500,000,000,000,000,000,000 tons, and its impact, by the formula given above, would be 1,025,000,000,000,000,000,000,000,000,000 foot-tons. Making the same supposition as in the case of our cannon ball, the final pressure would be that here stated.

† Tyndall, J., Heat considered as a mode of motion, Am. ed., p. 57, New York, 1863.

‡ Rankine. (The steam engine and other prime movers, London, 1866), gives the efficiency of steam engines as from 1-15th to 1-20th of the heat of the fuel.

Armstrong, Sir Wm., places this efficiency at 1-10th as the maximum. In practice the average result is only 1-30th. Rep. Brit. Assoc, 1863, p. liv.

Helmholtz, H. L. F., says "The best expansive engines give back as mechanical work only eighteen per cent of the heat generated by the fuel." Interaction of Natural Forces, in Correlation and Conservation of Forces, p. 227.

§ Thomsen, Julius, Poggendorff's Annalen, cxxv, 348. Also in abstract in Am. J. Sci., II xli, 296, May, 1866.

¶ American Journal of Science, II, xli, 214, March, 1866.

‖ In this calculation the annual evaporation from the ocean is assumed to be about nine feet. (See Dr. Buist, quoted in Maury's Phys. Geography of the Sea, New York, 1861, p. 11.) Calling the water area of our globe 150,000,000 square miles, the total evaporation in tons per minute would be that here given. Inasmuch as 30,000 pounds raised one foot high is a horse-power, the number of horse-powers necessary to raise this quantity of water 3½ miles in one minute is 2,757,000,000,000. This amount of energy is precisely that set free again when this water falls as rain.

So, when the oxygen and the zinc of the ore are separated in the furnace, the actual energy of heat becomes the potential energy of chemical attraction, which again becomes actual in the form of electricity when the zinc is dissolved in an acid. We see, then, that not only may any form of force or actual energy be stored up as any form of attraction or potential energy, but that the latter, from whatsoever source derived, may appear as heat, light, electricity, or mechanical motion.

Having now established the fact of correlation for the physical forces, we have next to inquire what are the evidences of the correlation of the vital forces with them. But in the first place it must be remarked that life is not a simple term like heat or electricity; it is a complex term, and includes all those phenomena which a living body exhibits. In this discussion, therefore, we shall use the term vital force to express only the actual energy of the body, however manifested. As to the attractions or the potential agency of the organism, nothing is more fully settled in science than the fact that these are precisely the same within the body as without it. Every particle of matter within the body obeys implicitly the laws of the chemical and physical attractions. No overpowering or supernatural agency comes in to complicate their action, which is modified only by the action of the others. Vitality, therefore, is the sum of the energies of a living body, both potential and actual.

Moreover, the important fact must be fully recognized that in living beings we have to do with no new elementary forms of matter. Precisely the same atoms which build up the inorganic fabric, compose the organic. In the early days of chemistry, indeed, it was supposed that the complicated molecules which life produced were beyond the reach of simple chemical law. But as more and more complex molecules have been, one after another, produced, chemistry has become re-assured, and now doubts not her ability to produce them all. A few years hence, and she will doubtless give us quinine and protagon, as she now gives us coumarin and neurine, substances the synthesis of which was but yesterday an impossibility.*

* Compare Odling, Wm., Lectures on Animal Chemistry, London, 1866. "In broad antagonism to the doctrines which only a few years back were regarded as indisputable, we now find that the chemist, like the plant, is capable of producing from carbonic acid and water a whole host of organic bodies, and we see no reason to question his ultimate ability to reproduce all animal and vegetable principles whatsoever." (p. 52.)

"Already hundreds of organic principles have been built up from their constituent elements, and there is now no reason to doubt our capability of producing all organic principles whatsoever in a similar manner." (p. 56.)

Dr. Odling is the successor of Faraday as Fullerian Professor of Chemistry in the Royal Institution of Great Britian.

In studying the phenomena of living beings, it is important also to bear in mind the different and at the same time the coördinate purposes subserved by the two great kingdoms of nature. The food of the plant is matter whose energy is all expended; it is a fallen weight. But the plant-organism receives it, exposes it to the sun's ray, and, in a way yet mysterious to us, converts the actual energy of the sunlight into potential energy within it. The fallen weight is thus raised, and energy is stored up in substances which now are alone competent to become the food of the animal. This food is not such because any new atoms have been added to it; it is food because it contains within it potential energy, which at any time may become actual as force. This food the animal now appropriates; he brings it in contact with oxygen, and the potential energy becomes actual; he cuts the string, the weight falls, and what was just now only attraction, has become actual force; this force he uses for his own purposes, and hands back the oxydized matter, the fallen weight, to the plant to be again de-oxydized; to be again raised. The plant then is to be regarded as a machine for converting sunlight into potential energy; the animal, a machine for setting the potential energy free as actual, and economizing it. The force which the plant stores up is undeniably physical; must not the force which the animal sets free by its conversion, be intimately correlated to it?

But approaching our question still more closely, let us, in illustration of the vital forces of the animal economy, choose three forms of its manifestation in which to seek for the evidences of correlation; these shall be heat, evolved within the body; muscular energy or motion; and lastly, nervous energy, or that form of force which, on the one hand, stimulates a muscle to contract, and on the other, appears in forms called mental.

The heat which is produced by the living body is obviously of the same nature as heat from any other source; it is recognized by the same tests, and may be applied for the same purposes. As to its origin, it is evident, that since potential energy exists in the food which enters the body, and is there converted into force, a portion of it may become the actual energy of heat. And since, too, the heat produced in the body is precisely such as would be set free by the combustion of this food outside of it, it is fair to assume that it thus originates. To this may be added the chemical argument that while food capable of yielding heat by combustion is taken into the body, its constituents are completely or almost completely, oxydized before

leaving it; and since oxydation always evolves heat, the heat of the body must have its origin in the oxydation of the food. Moreover, careful measurements have demonstrated that the amount of heat given off by the body of a man weighing 180 pounds, is about 2,500,000 units. Accurate calculations have shown, on the other hand, that 288·4 grams of carbon and 12·56 grams of hydrogen are available in the daily food for the production of heat. If burned out of the body, these quantities of carbon and hydrogen would yield 2,765,134 heat units. Burned within it, as we have just seen, 2,500,000 units appear as heat; the rest in other forms of energy.* We conceive, however, that no long argument is necessary to prove that animal heat results from a conversion of energy within the body, or that the vital force heat is as truly correlated to the other forces as when it has a purely physical origin.

The belief that the muscular force exerted by an animal is created by him, is by no means confined to the very earliest ages of history. Traces of it appear to the careful observer even now, although, as Dr. Frankland says, science has proved that "an animal can no more generate an amount of force capable of moving a grain of sand than a stone can fall upward, or a locomotive drive a train with out fuel."† In studying the characters of muscular action we notice, first, that, as in the case of heat, the force which it develops is in nowise different from motion in inorganic nature. In the early part of the lecture, motion produced by the contraction of muscle, was used to show the conversion of mass force into molecular force. No one in this room believes, I presume, that the result would have been at all different, had the motion been supplied by a steam engine or a water wheel. Again, food, as we have seen, is of value for the potential energy it contains, which may become actual in the body. Liebig, in 1842, asserted that for the production of muscular force, the food must first be converted into muscular tissue,‡ a view until recently accepted by physiologists.§ It has been conclusively shown, however, within a few years, that

* Marshall, John, Outlines of Physiology, American edition, 1868, p. 916.

† Frankland, Edward, On the Source of Muscular Power, Proc. Roy. Inst., June 8, 1866; Am. J. Sci., II, xlii, 393, Nov. 1866.

‡ Liebig, Justus von, Die organische Chemie in ihrer Anwendung auf Physiologie und Pathologie, Braunschweig, 1842. Also in his Animal Chemistry, edition of 1852 (Am. ed., p. 26), where he says "Every motion increases the amount of organized tissue which undergoes metamorphosis."

§ Compare Draper, John Wm., Human Physiology. Playfair, Lyon, On the Food of Man in relation to his useful work; Edinburgh, 1865; Proc. Roy. Inst., April 28, 1865. Ranke, Tetanus eine Physiologische Studie; Leipzig, 1865. Odling, *op. cit.*

muscular force cannot come from the oxydation of its own substance, since the products of this metamorphosis are not increased in amount by muscular exertion.* Indeed, reasoning from the whole amount of such products excreted, the oxydation of the amount of muscle which they represent would furnish scarcely one-fifth of the mechanical force of the body. But while the products of tissue oxydation do not increase with the increase of muscular exertion, the amount of carbonic gas exhaled by the lungs is increased in the exact ratio of the work done.† No doubt can be entertained, therefore, that the actual energy of the muscle is simply the converted potential energy of the carbon of the food. A muscle, therefore, like a steam engine, is a machine for converting the potential energy of carbon into motion. But unlike a steam engine, the muscle accomplishes this conversion directly, the energy not passing through the intermediate stage of heat. For this reason, the muscle is the most economical producer of mechanical force known. While no machine whatever can transform all of the energy into motion, the most economical steam engines utilizing only one-twentieth of the heat, the muscle is able to convert one-fifth of the energy of the food into work.‡ The other four-fifths must, therefore, appear as heat. Whenever a muscle contracts, then four times as much energy appears as heat as is converted into motion. Direct experiments by Heidenhain have confirmed this, by showing that an important rise of temperature attends muscular contraction; § a fact, however, apparent to any one who has ever taken active exercise. The work done by the animal body is of two sorts, internal and external. The former includes the action of the heart, of the respiratory muscles, and of those assisting the digestive process. The latter refers to the useful work the body may perform. Careful estimates place the entire work of the body at about 800 foot-tons daily; of which 450 foot-tons is internal, 350 foot-tons external work. And since the internal work ultimately appears as

* Voit, E., Untersuchungen über den Einfluss des Kochsalzes, des Kaffees, und der Muskelbewegungen auf den Stoffwechsel; Munich, 1860. Smith, E., Philosophical Transactions, 1861, 747. Fick, A., and Wislicenus, J., Phil. Mag., IV., xxxi., 485. Frankland, E., *loc. cit.* Noyes, T. R., American Journal Medical Sciences, Oct., 1867. Parkes, E. A., Proceedings Royal Society, xv., 339; xvi., 44.

† Smith, Edward, Philosophical Transactions, 1859, 709.

‡ Authorities differ as to the amount of energy converted by the steam engine. (See Note 16.) Compare Marshall, *op. cit.*, p. 918. "Whilst, therefore, in an engine one-twentieth part only of the fuel consumed is utilized as mechanical power, one-fifth of the food absorbed by man is so appropriated."

§ Heidenhain, Mechanische Leistung Warmeentwickelung und Stoffumstaz bei der Muskelthatigkeit, Breslau, 1864. See also Haughton, Samuel, on the relation of food to work, published in "Medicine in Modern Times," London, 1869, Macmillan & Co.

heat within the body, the actual loss of heat by the production of motion is the equivalent of the 350° foot-tons which represents external work. This, by a simple calculation, will be found to be 250,000 heat units, almost the precise amount by which the heat yielded by the food when burned without the body, exceeds that actually evolved by the organism. Moreover, while the total heat given off by the body is 2,500,000 units, the amount of energy evolved as work is equal to about 600,000 heat units; hence the amount of work done by a muscle is as above stated, one-fifth of the actual energy derivable from the food. One point further. The law of correlation requires that the heat set free when a muscle in contracting does work, shall be less than when it effects nothing; this fact, too. has been experimentally established by Heidenhain.* So, again, when muscular contraction does not result in motion, as when one tries to raise a weight too heavy for him, the energy which would have appeared as work, takes the form of heat; a result deducible by the law of correlation from the steam engine.

The last of the so-called vital forces which we are to examine, is that produced by the nerves and nervous centers. In the nerve which stimulates a muscle to contract, this force is undeniably motion, since it is propagated along this nerve from one extremity to the other. In common language, too, this idea finds currency in the comparison of this force to electricity; the gray or cellular matter being the battery, the white or fibrous matter the conductors. That this force is not electricity, however, Du Bois-Reymond has demonstrated by showing that its velocity is only ninety-seven feet in a second, a speed equaled by the greyhound and the race-horse.† In his opinion, the propagation of a nervous impulse is a sort of successive molecular polarization, like magnetism. But that this agent is a force, as analogous to electricity as its magnetism, it is shown not only by the fact that the transmission of electricity along a nerve will cause the contraction of the muscle to which it leads, but also by the more important fact that the contraction of a muscle is excited by diminishing its normal electrical current;‡ a result which could take place only with a stimulus closely allied to electricity. Nerve-force, therefore, must be transmuted potential energy.

* Heidenhain, *op. cit.* Also by Fick, Untersuchungen uber Muskel-arbeit, Basel, 1867. Compare also "Nature," i, 159, Dec. 9, 1869.

† Du Bois-Reymond, Emil, On the time required for the transmission of volition and sensation through the nerves, Proc. Roy. Inst. Also in Appendix to Bence Jones's Croonian lectures.

‡ Marshall, *op. cit.*, p. 227.

What, now, shall we say of that highest manifestation of animal life, thought-power? Has the upper region called intelligence and reason, any relations to physical force? This realm has not escaped the searching investigation of modern science; and although in it investigations are vastly more difficult than in any of the regions thus far considered, yet some results of great value have been obtained, which may help us to a solution of our problem. It is to be observed at the outset that every external manifestation of thought-force is a muscular one, as a word spoken or written, a gesture, or an expression of the face; and hence this force must be intimately correlated with nerve-force. These manifestations reaching the mind through the avenues of sense, awaken accordant trains of thought only when this muscular evidence is understood. A blank sheet of paper excites no emotion; even covered with Assyrian cuneiform characters, its alternations of black and white awaken no response in the ordinary brain. It is only when, by a frequent repetition of these impressions, the brain-cell has been educated, that these before meaningless characters awaken thought. Is thought, then, simply a cell action which may or may not result in muscular expression—an action which originates new combinations of truth only, precisely as a calculating machine evolves new combinations of figures? Whatever we define thought to be, this fact appears certain, that it is capable of external manifestation by conversion into the actual energy of motion, and only by this conversion. But here the question arises, Can it be manifested inwardly without such a transformation of energy? Or, Is the evolution of thought entirely independent of the matter of the brain? Experiments, ingenious and reliable, have answered this question. The importance of the results will, I trust, warrant me in examining the methods employed in these experiments somewhat in detail. Inasmuch as our methods for measuring minute amounts of electricity are very perfect, and the methods for the conversion of heat into electricity are equally delicate, it has been found that smaller differences of temperature may be recognized by converting the heat into electricity, than can be detected thermometrically. The apparatus, first used by Melloni in 1832,* is very simple, consisting first, of a pair of metallic bars like those described in the early part of the lecture, for effecting the conversion of the heat; and second, of a delicate galvanometer, for measuring the electricity produced. In the the experiments in question one of the bars used was

* Melloni, Ann. Ch. Phys., xlviii, 198. See also Nobili, Bibl. Univ., xliv, 225, 1830; lvii, 1, 1834.

made of bismuth, the other of an alloy of antimony and zinc.* Preliminary trials having shown that any change of temperature within the skull was soonest manifested externally in that depression which exists just above the occipital protuberance, a pair of these little bars was fastened to the head at this point; and to neutralize the results of a general rise of temperature over the whole body, a second pair, reversed in direction, was attached to the leg or arm, so that if a like increase of heat came to both, the electricity developed by one would be neutralized by the other, and no effect be produced upon the needle unless only one was affected. By long practice it was ascertained that a state of mental torpor could be induced, lasting for hours, in which the needle remained stationary. But let a person knock on the door outside the room, or speak a single word, even though the experimenter remained absolutely passive, and the reception of the intelligence caused the needle to swing through twenty degrees.† In explanation of this production of heat, the analogy of the muscle at once suggests itself. No conversion of energy is complete; and as the heat of muscular action represents force which has escaped conversion into motion, so the heat evolved during the reception of an idea, is energy which has escaped conversion into thought, from precisely the same cause. Moreover, these experiments have shown that ideas which affect the emotions, produce most heat in their reception; "a few minutes' recitation to one's self of emotional poetry, producing more effect than several hours of deep thought." Hence it is evident that the mechanism for the production of deep thought, accomplishes this conversion of energy far more perfectly than that which produces simply emotion. But we may take a step further in this same direction. A muscle, precisely as the law of correlation requires, develops less heat when doing work than when it contracts without doing it. Suppose, now, that beside the simple reception of an idea by the brain, the thought is expressed outwardly by some muscular sign. The conversion now takes two directions, and in addition to the production of thought, a portion of the energy appears as nerve and muscle-power; less, therefore, should appear as heat, according to our law of correlation. Dr. Lombard's experiments have shown that the amount of heat developed by the recitation to one's self of emo-

* The apparatus employed is illustrated and fully described in Brown-Sequard's Archives de Physiologie, i, 499, June, 1868. By it the 1-4000th of a degree, Centigrade, may be indicated.

† Lombard, J. S., New York State Medical Journal, v. 198, June, 1867. [A part of these facts were communicated to me directly by their discoverer.]

tional poetry, was in every case less when that recitation was oral; *i. e.*, had a muscular expression. These results are in accordance with the well known fact that emotion often finds relief in physical demonstrations; thus diminishing the emotional energy by converting it into muscular. Nor do these facts rest upon physical evidence alone. Chemistry teaches that thought force, like muscle force, comes from the food, and demonstrates that the force evolved by the brain, like that produced by the muscle, comes not from the disintegration of its own tissue, but is the converted energy of burning carbon.* Can we longer doubt, then, that the brain, too, is a machine for the conversion of energy? Can we longer refuse to believe that even thought is, in some mysterious way, correlated to the other natural forces; and this, even in face of the fact that it has never yet been measured? †

I cannot close without saying a word concerning the part which our own country has had in the development of these great truths. Beginning with heat, we find that the material theory of caloric is indebted for its overthrow more to the distinguished Count Rumford than to any other one man. While superintending the boring of cannon at the Munich arsenal toward the close of the last century, he was struck by the large amount of heat developed, and

* Wood, L. H., On the influence of Mental activity on the Excretion of Phosphoric acid by the Kidneys. Proceedings Connecticut Medical Society for 1869, p. 197.

† On this question of vital force, see Liebig, Animal Chemistry. "The increase of mass in a plant is determined by the occurrence of a decomposition which takes place in certain parts of the plant under the influence of light and heat."

"The modern science of physiology has left the track of Aristotle. To the eternal advantage of science, and to the benefit of mankind it no longer invents a *horror vacui*, a *quinta essentia*, in order to furnish credulous hearers with solutions and explanations of phenomena, whose true connection with others, whose ultimate cause is still unknown."

"All the parts of the animal body are produced from a peculiar fluid circulating in its organism, by virtue of an influence residing in every cell, in every organ or part of an organ."

"Physiology has sufficiently decisive grounds for the opinion that every motion, every manifestation of force, is the result of a transformation of the structure or of its substance; that every conception, every mental affection, is followed by changes in the chemical nature of the secreted fluids; that every thought, every sensation is accompanied by a change in the composition of the substance of the brain."

"All vital activity arises from the mutual action of the oxygen of the atmosphere and the elements of the food."

"As, in the closed galvanic circuit, in consequence of certain changes which an inorganic body, a metal, undergoes when placed in contact with an acid, a certain something becomes cognizable by our senses, which we call a current of electricity; so in the animal body, in consequence of transformations and changes undergone by matter previously constituting a part of the organism, certain phenomena of motion and activity are perceived, and these we call life, or vitality."

"In the animal body we recognize as the ultimate cause of all force only one cause, the chemical action which the elements of the food and the oxygen of the air mutually exercise on each other. The only known ultimate cause of vital force, either in animals or in plants, is a chemical process."

"If we consider the force which determines the vital phenomena as a property of certain substances, this view leads of itself to a new and more rigorous consideration of certain singular phenomena,

instituted a careful series of experiments to ascertain its origin. These experiments led him to the conclusion that "anything which any isulated body or system of bodies can continue to furnish without limitation, cannot possibly be a material substance." But this man, to whom must be ascribed the discovery of the first great law of the correlation of energy, was an American. Born in Woburn, Mass., in 1753, he, under the name of Benjamin Thompson, taught school afterward at Concord, N. H., then called Rumford. Unjustly suspected of toryism during our revolutionary war, he went abroad and distinguished himself in the service of several of the governments of Europe. He did not forget his native land, though she had treated him so unfairly. When the honor of knighthood was tendered him, he chose as his title the name of the Yankee village where he had taught school, and was thenceforward known as Count Rumford. And, at his death, by founding a professorship at Harvard College, and donating a prize fund to the American Academy of Arts and Sciences at Boston, he showed his interest in her prosperity and advancement.* Nor has the field of vital forces been without earnest workers belonging to our own country. Professors John W. Draper† and Joseph Henry‡ were among the earliest explorers. And in 1851 Dr. J. H. Watters, now of St. Louis, published a theory of the origin of vital force, almost identical with that for which Dr. Carpenter, of London, has of late received so much credit. Indeed, there is some

which these very substances exhibit, in circumstances in which they no longer make a part of living organisms."

Also Owen, Richard (Derivative Hypothesis of Life and Species, forming the 40th chapter of his Anatomy of Vertebrates, published in Am. J. Sci., II, xlvii, 33, Jan. 1869.) "In the endeavor to clearly comprehend and explain the functions of the combination of forces called 'brain,' the physiologist is hindered and troubled by the views of the nature of those cerebral forces which the needs of dogmatic theology have imposed on mankind." * * "Religion pure and undefiled, can best answer how far it is righteous or just to charge a neighbor with being unsound in his principles who holds the term 'life' to be a sound expressing the sum of living phenomena; and who maintains these phenomena to be modes of force into which other forms of force have passed, from potential to active states, and reciprocally, through the agency of these sums or combinations of forces impressing the mind with the ideas signified by the terms 'monad,' 'moss,' 'plant,' or 'animal.'"

And Huxley, Thos. H., "On the Physical Basis of Life," University series, No. 1. College Courant, 1870.

Per contra, see the address of Dr. F. A. P. Barnard, as retiring President, before the Am. Assoc. for the Advancement of Science, Chicago meeting, August, 1868. "Thought cannot be a physical force, because thought admits of no measure."

Gould, Benj. Apthorp, address as retiring President, before the American Association at its Salem meeting, August, 1869.

Beale, Lionel S., "Protoplasm, or Life, Matter, and Mind," London, 1870. John Churchill & Sons.

* For an excellent account of this distinguished man, see Youman's Introduction to the Correlation and Conservation of Forces, p. xvii.

† Draper, J. W., *loc. cit.*

‡ Henry, Joseph, Agric. Rep. Patent Office, 1857, 440.

reason to believe that Dr. Watters' essay may have suggested to the distinguished English physiologist the germs of his own theory.* A paper on this subject by Professor Joseph Leconte, of Columbia, S. C., published in 1859, attracted much attention abroad.† The remarkable results already given on the relation of heat to mental work, which thus far are unique in science, we owe to Professor J. S. Lombard, of Harvard College; ‡ the very combination of metals used in his apparatus being devised by our distinguished electrical engineer, Mr. Moses G. Farmer. Finally, researches, conducted by Dr. T. R. Noyes in the physiological laboratory of Yale College, have confirmed the theory that muscular tissue does not wear during action up to the point of fatigue, § and other researches by Dr. L. H. Wood have first established the great truth for brain tissue.¶ We need not be ashamed, then, of our part in this advance in science. Our workers are, indeed, but few; but both they and their results will live in the records of the world's progress. More would there be now of them were such studies more fostered and encouraged. Self-denying, earnest men are ready to give themselves up to the solution of these problems if only the means of a bare subsistence be allowed them. When wealth shall foster science, science will increase wealth—wealth pecuniary, it is true; but also wealth of knowledge, which is far better.

In looking back over the whole of this discussion, I trust that it is possible to see that the objects which we had in view at its commencement have been more or less fully attained. I would fain belive that we now see more clearly the beautiful harmonies of bounteous nature; that on her many-stringed instrument force answers to force, like the notes of a great symphony; disappearing now in potential energy, and anon reappearing as actual energy; in a multitude of forms. I would hope that this wonderful unity and mutual interaction of force in the dead forms of inorganic nature, appears to you identical in the living forms of animal and vegetable life, which make of our earth an Eden. That even that mysterious, and in many aspects awful, power of thought, by which

* Watters, J. H., An Essay on Organic, or Life-force. Written for the degree of Doctor of Medicine in the University of Pennsylvania, Philadelphia, 1851. See also St. Louis Medical and Surgical Journal, II, v, Nos. 3 and 4, 1868; December, 1868, and November 10, 1869.

† Leconte, Joseph, The Correlation of Physical, Chemical and Vital Force, and the Conservation of Force in Vital Phenomena. Americal Journal of Science, II, xxviii, 305, November, 1859.

‡ Lombard, J. S., *loc. cit.*

§ Noyes, T. R., *loc. cit.*

¶ Wood, L. H., *loc. cit.*

man influences the present and future ages, is a part of this great ocean of energy. But here the great question rolls upon us, Is it only this? Is there not behind this material substances, a higher than molecular power in the thoughts which are immortalized in the poetry of a Milton or a Shakespeare, the art creations of a Michael Angelo or a Titian, the harmonies of a Mozart or a Beethoven? Is there really no immortal portion separable from this brain-tissue, though yet mysteriously united to it? In a word, does this curiously-fashioned body incloses a soul, God-given and to God returning? Here science veils her face and bows in reverence before the Almighty. We have passed the boundaries by which physical science is inclosed. No crucible, no subtle magnetic needle can answer now our questions. No word but His who formed us, can break the awful science. In presence of such a revelation science is dumb, and faith comes in joyfully to accept that higher truth which can never be the object of physical demonstration.

SCIENTIFIC LECTURE--IV.

ON AIR AND RESPIRATION.

BY PROF. J. C. DRAPER, OF THE COLLEGE OF THE CITY OF NEW YORK.

Judge Daly, Vice-President of the Institute, introduced the lecturer, who spoke as follows:

LADIES AND GENTLEMEN.—We have met this evening to discuss a subject of vital importance to every living creature. In whatever light we may view it we can do but very imperfect justice to so suggestive a theme in one lecture; but since time is our inexorable master, in this [as in all other things, it only remains for us to accomplish what we may in the brief allotted space of a single hour.

Atmospheric air bears a three-fold relation to respiration, for we may consider their connection from a mechanical, chemical or physiological standpoint. It is more especially to the second and third of these that we call your attention to-night, since they have a practical value that is self evident.

In past times this impalpable, invisible, gaseous envelope of our earth was regarded as an elementary body, but more exact methods of research have demonstrated that it is not simple but very composite, containing two classes of ingredients: 1. Those which do not vary in their relative proportion to each other and to the whole mass; 2. Those which are so variable that the proportions change with every succeeding hour, and, we might almost say, with every succeeding moment.

To place these components in the clearest light, we have arranged them in a tabular form, a glance at which will show how rapidly we must proceed to perform a mere tithe of the work that is before us:

Invariable.	Variable.	
Nitrogen.	Carbonic acid.	Ammonia.
Oxygen.	Carbonic oxyd.	Vapor of water.
	Ozone.	Sulphuretted hydrogen.
	Nitric acid.	Corpuscles and various vapors.

To understand the chartacter of this composite atmosphere, some explanations and experimental illustrations of the properties of the prominent constituents are necessary. In pursuance of this plan your attention is called to the jar placed upon the table. It has been filled with nitrogen gas; as you perceive, it is colorless, and if you were to test it as regards its taste and smell, you would find it devoid of both. It, however, possesses properties of interest in its relation to combustion and respiration. To illustrate the first of these, I introduce a few candle flames into the atmosphere of nitrogen. As you see, they are instantly extinguished, not even a spark remaining to bear witness to the action that a few seconds ago was so vivid and beautiful. If, instead of the candle flame, we place a living, warm blooded creature in nitrogen gas, the vital flame that animates it, giving the powers of motion, sensation and will, is also extinguished, and like the candle flame, it has gone, no man knows whither.

From nitrogen let us turn to the second of the invariable constituents. Here we meet with an altogether different substance, and though, as we look at the oxygen in yonder jar, it is not visibly distinguishable from the nitrogen we have just examined, but is equally colorless, odorless and tasteless, we find that it acts in a very different manner when the candle flames are submitted to its influence. See how brilliant they become as they dip into and drink up the vital air, as it has been so aptly named. See how rapidly the combustible wax wastes away. Even the candles that only bore sparks, are now crowned with brilliant flames. Could any action contrast more thoroughly with that we witnessed a few moments ago? That annihilated the flames, this vitalizes them.

Though the experiment you have seen gives an idea of the difference in the chemical action of these two gases, it does not afford as just an estimate of the power of oxygen as may be obtained from the illustrations to which your attention is now called. Sulphur (as all who have ignited a lucifer match know) burns with a feeble, pale blue flame, but see how it acts in the atmosphere of oxygen. How great the increase in the rapidity of combustion! How beautiful the light! Watch the heated products of combustion as they rise to the top of the jar to seek an outlet, and so afford an illustration of the means to which we must resort if we desire to remove the foul gases from an apartment, and ventilate it successfully.

The last illustration of the properties of oxygen that we shall

introduce, is the burning of phosphorus in this gas. This is justly described as one of the most brilliant of all chemical experiments. In the air phosphorus burns with vigor, but as it passes into the atmosphere of pure oxygen, the union of this gas with the combustible is so active, and the light emitted so intense, that one may as well attempt to gaze on the noonday sun as on the jar in which phosphorus is burning in oxygen.

Having described the constituents that are always present in the same proportions in the air, whether it be taken from the sealed vases of Herculaneum, or from the atmosphere as it now is, it remains that we should demonstrate that these gases are actually present. To accomplish this, I take a jar half filled with a colorless gas called the deutoxyde of nitrogen, and, raising it from the water in which it is resting, allow air to flow in. The gas instantly unites with it, brown fumes are produced, which are converted into an acid that unites with the water, as we may show by the addition of a little blue litmus, which is instantly turned red. Examining the gas that remains in the jar, we find that it cannot support combustion, it is therefore the nitrogen with which we are already acquainted.

Turning from this brief review of the properties of the leading constituents of the air, let us reflect for a moment on the advantages gained by the mixture of these two bodies. Either gas alone is incompetent to carry on the manifold processes connected with our daily life. Existence in an atmosphere of nitrogen is impossible, and even though we might live in a pure oxygen air, we should be confined to a diet of raw meats and grain, for it would be impossible to use fire in the preparation of food, since both the viands and the utensils employed in their preparation, would be consumed in the fierce heat that oxygen generates; and if, as many think, man's nature is dependent on his food, we should be but little advanced beyond the lowest savages on our globe.

By means of suitable and ingeniously constructed mechanical contrivances, which we cannot now stop to describe, the air is conveyed into the lungs and there brought into intimate contact with the blood as it courses through these organs. The oxygen is absorbed by the discs or floating cells of the fluid, and conveyed to the remotest recesses of the system, to assist in carrying on the processes of life. While these cells are laden with the vitalizing gas, they have a bright red or arterial color, but when the oxygen is lost their brilliant tint disappears, they assume a darker hue, and are returned to

the lungs to receive another portion of oxygen. Thus, time after time, these indefatigable little laborers bear their burden of life, giving gas to the tissue of the body, until at last they are worn out in the service, and dying in the performance of their duty, finally pass away to give room to new generations of discs, that have arisen and usurped their places and duties.

Though oxygen is thus continually introduced into the system in considerable quantities, carefully conducted experiments have shown that only small traces of nitogen are absorbed and exhaled, and these are so insignificant that they are generally ignored. We may, therefore, say that the chief use of the nitrogen is to dilute the oxygen, and as we reduce the strength of a fiery alcholic liquid by the addition of water, so the combustion supporting power of oxygen, is reduced by mingling it with diluting nitrogen and an air of mild and suitable properties formed.

From the invariable we pass to the variable components; though these are small in quantity, they are very important, carbonic acid and carbonic oxyd occupying a prominent position. To the first of these your attention is now directed.

Again we find that the subject of our examination is a colorless gas, as is evidenced by the jar of carbonic acid now before you. It looks like either oxygen or nitrogen, but if we taste and smell it, we find that it affects both of these senses, possessing a pungent agreeable taste, and an odor of a like nature. Testing it by the flame, the latter is extinguished, the gas acting in this respect like nitrogen, but differing from it in that, it is so heavy that it may be poured from one vessel into another, where its presence may be shown by a flame. Another test for the presence of carbonic acid is lime water, to which it imparts a milky appearance, as is demonstrated by passing some of the gas through the colorless lime water contained in this vase.

If we investigate the action of carbonic acid on living creatures we find that if it is concentrated it quickly destroys the life of a warm blooded animal, and even when very dilute, acts as a narcotic poison. Under ordinary circumstances it occurs to the extent of from two to five parts in 10,000 of air, but in theatres and public halls the proportion sometimes rises to 100 parts in ten thousand. Of its copious production and accumulation, in crowded rooms, we may readily satisfy ourselves by passing the air of such an apartment through a column of colorless lime water, as in the experiment we have here arranged, when at once its presence is made evident.

Examining into the origin of carbonic acid, we find that it is one of the products of the combustion of all vegetable and animal structures, as is easily shown by burning these substances or a portion of charcoal in oxygen and then submitting the products of combustion to the lime-water test. Processes of respiration also produce a similar result, there is then a double reason for the accumulation of this in the air of public buildings.

It is interesting to note that though carbonic acid is heavier than air, it is not found in the greatest proportion near the floor, nor is it distributed equally throughout the air of an apartment. Roscoe, for example, discovered that in a theatre there were twenty-seven parts of carbonic acid in 10,000 of air, at a distance of four feet above the stage, while the proportion arose to thirty-four parts at a height of thirty-four feet. In a library near the table the proportion was twelve, and near the ceiling sixteen. This ascent of the carbonic acid, produced by combustion and respiration is owing to the expansion of the gas by the heat developed in both of these processes, and, as in the combustion of sulphur in oxygen, it was evident that the proper method for allowing the products of the action to escape was by making an opening in the top of the jar; so in the case of rooms, if we would ventilate them we must make the opening of exit for the foul gases near to the ceiling.

The second of the variable ingredients is carbonic oxyd. It is also formed by the union of charcoal with oxygen, and is produced whenever the supply of air is insufficient. Evolving it, as in the experiment before you, it is found to be a colorless combustible gas, burning with a pale blue flame, that we have all seen playing over the surface of an anthracite fire that has been recently replenished. Like carbonic acid, carbonic oxyd is a noxious gas, but far more energetic and destructive, since it acts upon the blood discs, turning them permanently red, and unfitting them to serve as the carriers of oxygen to the tissues. It is therefore cumulative in its action, and a very small proportion is capable of producing profound physiological results if the air, thus contaminated, is breathed for a considerable period of time.

It is a very common opinion that carbonic acid is the most serious vitiator of the air, but if we investigate the relation of carbonic oxyd to iron, we find that, in rooms warmed by stoves and furnaces, the latter gas is probably in a majority of instances the chief culprit; for though metallic iron is almost impervious to this gas at ordinary tem-

peratures, it allows its passage like water through a sieve when the temperature is raised to a bright red heat. Usually this is the condition of a stove or furnace in the winter season, and it necessarily follows, that whenever carbonic oxyd is produced, it must escape through the iron and gain access to the air of the apartment, unless we employ a proper lining of soapstone or some material which shall keep the metal at a lower temperature.

The next gas to which your attention is called is ozone. Its properties are similar to those of oxygen; and it is in reality a modified or active form of that element, possessing the power of uniting with many substances at the ordinary temperatures of the air, while oxygen, as we have seen, requires the heat to be raised to the point of ignition. Its presence is determined by its action upon paper that has been dipped in an aqueous solution of starch and iodide of potassium—this it turns from a white to a blue or brown color, according as it is more or less concentrated. Owing to its active oxydizing power, ozone is a valuable disinfectant, since it can decompose noxious gases and vapors, converting them into harmless bodies; and there is good reason for supposing that the purity of the air, after a thunder storm, is in part owing to the conversion of a portion of its oxygen into ozone, and the consequent removal of the offensive ingredients. It has been stated that some epidemics, of which cholera is an example, reach their point of greatest malignancy when ozone has disappeared from the air; and that the decline of the epidemic and its disappearance is marked by the reappearance of ozone. In rural districts it is nearly always present, while in the interior of large cities it is almost as uniformly absent, owing to the fact that it has been consumed in destroying the foul emanations that prevail in these localities. Since ozone is very irritating to the respiratory organs, it has been suggested that the sudden appearance of diseases of the air passages is in all probability due to the occurrence of a wind highly charged with this gas. It certainly is a plausible explanation of the manner in which influenza will in a single night attack half the inhabitants of a locality.

It is a well ascertained and indubitable fact that under the influence of sunlight green plants decompose carbonic acid, and set oxygen gas free. This is generally regarded as a direct action of the light, but experiments have shown that if the gas dissolved in water is carefully removed before the plant is introduced, even though carbonic acid is supplied in sufficient quantity, the plant cannot decom-

pose it in the light until the water is again charged with air. There is, therefore, some probability that the decomposition of carbonic acid by plants is not a direct, but an indirect action, accomplished through the agency of ozone. Whether this is true or not, it at least affords a highly interesting and instructive field of inquiry that promises a rich reward to those who elect to reap therein.

Nitric acid is only found after storms that have been attended by vivid flashes of lightning. It is of little interest.

The ammonia in the air is one of the products of putrefaction and decay. It occurs in largest quantity whenever these changes are taking place. A minute trace is always discoverable; but small as it is, it bears an important relation to the vegetable kingdom, since it is the natural stimulant of the growth of plants. One of the characteristic properties of this substance is its exceeding solubility in water, as is shown by the experiment known as the ammonia fountain. Owing to this solubility the rain that descends after a protracted drought seizes upon the accumulated ammonia in the air, and, conveying it to plants, produces the increased richness of verdure that follows these storms.

Of the variable ingredients of the air, the vapor of water is liable to the greatest mutations. These are more or less familiar to us in the fogs and clouds that appear and disappear without visible cause or reason. In addition to the fog-like state, the vapor of water also possesses a colorless, transparent condition, as in the experiment we have arranged in which water is boiling in a flask. The interior of the vessel is, of course, filled with steam or vapor of water, but it is as invisible as the atmospheric air. It is only when it issues from the jet that it presents the fog-like condition. If we place a thermometer in this issuing cloud the temperature is below the boiling point of water, and if we let the steam fall on a slip of glass and place it under the microscope we discover that the glass is covered with minute vesicles or bladders of water. We therefore conclude that the fog-like appearance is not steam, but condensed water; true steam being colorless and invisible, as we have just demonstrated. In its physiological relations the vapor of water in the air presents facts of interest. It is a well established law that the rate of vaporization is dependent upon the amount of vapor already existing in a given space. When, therefore, the air is already saturated, as we might say, with aqueous vapor, the escape of the insensible perspiration or vapor from the lungs and skin is interfered with, and the slightest

muscular exertion is attended by a copious flow of ordinary fluid perspiration. The system attempting in this manner to throw off the heat resulting from the oxydation required to produce the muscular effort, on another day when the air is dry, or the amount of moisture far below the point of saturation, great muscular effort may produce but little visible perspiration, even though the thermometer indicates a higher temperature. In this case vaporization from the body has been copious and sufficient to carry off the heat as fast as it was produced, and the full cooling effect of the process has been realized.

Sulphureted hydrogen is the most offensive to the senses of all the components of the air. Like the other gases and vapors we have examined, it is colorless, possessing an odor which may be described as resembling that emitted by an egg in an advanced state of putrefaction. This property, by indicating its presence, generally protects us from its evil effects; and even when the proportion is too minute to affect the sense of smell, we may still detect it by its action on various metallic compounds, some of which, as the carbonate of lead, are employed in the painting of wood work. In illustration of this property, the gas, as it is evolved from a suitable apparatus, is passed through various solutions of metallic salts, when, as you perceive, the metallic sulphides are thrown down, or, in chemical parlance, precipitated as solids of different and sometimes brilliant colors. In the case of the lead salt, the precipitate is black, explaining to us the darkening that occurs in lead paints when they are exposed to the continued action of this gas.

In its physiological relation sulphureted hydrogen is a narcotic poison, and endowed with energy, even when the proportion is very small. It acts on the iron of the blood discs, darkening it as it did the iron salt in yonder vessel, and, destroying the power of the disc to perform its function, produces a cumulative effect, as was the case with carbonic oxyd.

The corpuscles or floating cells in the air are of many different kinds. Some are the germs of cryptogamic and other lowly forms of plant life, and there is but little doubt that many of the diseases called contagious are conveyed by corpuscles or germs which attach themselves to the motes that we see dancing in the path of a sunbeam and freight them with a poison which, when it is introduced into the respiratory apparatus of some unfortunate creature, generates the disease from which it was born.

The last of the constituents of the air indicated in our table are the vapors with which it is charged. These are sometimes pleasant and agreeable, as is the case with the emanations from the great majority of flowers; but what shall we say of the vile odors from the kitchen and laundry that meet our nostrils as we cross the thresholds of many houses. It has been suggested that on the walls of our apartments there lie concealed the impressions of all the shadows that have fallen on them, and that perhaps we may some day learn how to evolve them, as we now do those that have fallen on a photographic surface. Beautiful as this idea is, there is but small hope of its ever being realized, unless we first seek and discover the means of exorcising the palpable ghosts of many dinners that cover the walls so thickly that even he who calculated how many angels could dance on the point of a needle would fail to number them. Aroma from fine wines and costly spices, rich and juicy emanations from viands roasted, boiled and baked, odors strong and penetrating from vegetables, delicate and delicious from fruits and flowers. There they all lie blended together, covering and entombing the shadowy forms that passing figures have cast. The immaterial being lost in the material, who shall attempt their separation.

SCIENTIFIC LECTURE—V.

THE CONNECTION OF NATURAL SCIENCE AND MENTAL PHILOSOPHY.

By Professor J. Bascom, of Williams College, Mass.

Judge Charles P. Daly, Vice-President, introduced Prof. Bascom, who spoke substantially as follows:

I am obliged to you, ladies and gentlemen, for this opportunity of speaking in defense of metaphysics. It has been a long time since mental philosophy has stood in the van in the advance of knowledge; a long time since the great intellects of the world have given themselves to metaphysics; a long time since the pre-eminence of Grecian philosophers, or since students by thousands gathered at the feet of Abelard. The progress in knowledge has been much like the advance of population over the globe. We have taken possession of continent after continent, and while we have entered upon one we have always lost some ground in that from which we have departed. We have not succeeded in taking hold of the new without in a measure losing our grasp of the old. The field of knowledge on which we are now entering, whereon we are laying down our landmarks of ownership and possession, is especially that of the natural sciences, that of the external and physical world; and in connection with this we have lost some hold on the spiritual and intellectual world. It has been thought that the inquiries of metaphysics have been unprofitable, have been untrustworthy in the results reached, and, above all, that they have not been productive, that they have not added to the wealth and progress the wares and warehouses of commerce of things which are the great characteristics, the striking features of our age. It has been felt that while the mind may indeed have been quickened somewhat by these inquiries that the cold, clear, judicious judgment with which we thread the ways of economy have been lost in connection with them. Perhaps there is something of

truth in this accusation. If one is gazing at the stars, it is evident that he may stumble over the stones at his feet; and yet that is not a sufficient reason why he should not sometimes look at the heavens. But the action which I most deprecate in connection with metaphysics is the presentation of false conclusions, is not merely turning away from this field of inquiry, but putting in the place of it that which is not its fair representative.

THE POWER OF THE MIND.

There is a disposition in our times especially to look upon mind as the product of the external world; to regard it as played upon by the external world, by visible things, by audible things, by things tasted and handled, till finally we conceive it as produced by things altogether outside of it; and not as giving form and knowledge to the world in the midst of which it is placed as the great creative agent. I wish to urge upon you this evening the power of the mind and its independence, the fact that it brings to the material about it the key of knowledge, and does not acquire that key, those methods of explanation from the external world. In reaching this end I invite your attention first to the power of the mind in connection with the senses. How does the external matter, material of the senses, present itself in the hands of the physicist? Take the eye, for instance. He inquires into the character of light. He finds it may be resolved into motion, and the various colors into various kinds of motion of different degrees of rapidity. He traces this motion to the retina, and all he knows there of it is still motion. He has now reached the nerve, and through this passes on to the brain. Everywhere, as the result of his inquiry, he meets with motion, a change of molecular relations. The last point to which he can trace this process is the gray matter of the brain, homogeneous in its structure. The same is found to be true of the ear. All its phenomena are resolvable into motion, a motion passing on to the gray nervous center. Thus in each of the senses, whether the sensation takes its rise in physical or chemical force, the upshot is another modification, by motion, of the substance of the brain. Remember now that this nervous matter is homogeneous, and that out of this one material the mind builds up for itself all that comes to it from the external world. Is not, therefore, the most marvelous thing in this process the constructive power of the mind; the transforming power of the mind by which it makes everything, as it were, out of nothing, out

of one material utterly unlike the product which is brought to us. [Applause.] I am sitting in my room, and the heat gently stealing over me, I raise my eyes, and they fall upon a fine work of art upon my mantel; my ear, at the same time, may be delighted with pleasant sounds, and a yet more pleasant voice on my right hand. Here are three forms of motion stealing upon my body, and transformed into an atmosphere of quiet and delicious comfort. Of these products of the mind, these three external conditions, the physicist can say nothing more than they are all one, all some form of motion. Thus what he loses sight of in the physical world as one thing reappears in the intellectual world as entirely distinct and diverse forms of knowledge. The mind, by its own necromancy, pours from one bottle every variety of wine. From one state of a homogeneous gray mass, which the physical inquirer only knows as a phase of motion, the mind reaches the elevation of thought, the warmth of emotion, the firmness of purpose.

Suppose this black-board were a mirror. I should see at once the entire audience, and I should construct in the depths of that mirror a space in which to place that audience. Now, the mind does all this. I know that the audience in reality exists. I see this external fact, and I see at the same time the picture in the mirror. Everything is reversed as compared to the external fact. Yet, of these waves of motion, by my mental power, I can spread out an imaginary space, and create at once an entire equivalent to this external fact—an equivalent which has no existence save as my thought first creates it, and then looks upon it. The light coming to the board is thrown direct upon the eye, placing behind it this image of the mind. How little is the world except as the mind lays hold of it and makes it something. How much of power, of creative art, does it require to give due extension to the picture. If the poet is a creator, almost in the same degree is he who listens to the poetry in the spirit of the poet also a creator.

SCIENTIFIC CONCEPTIONS.

Passing from the senses, I invite your attention to the scientific conceptions for a second illustration of the power of the mind. Take, for instance, such a conception as that of the solar system. The mind needs to be powerfully trained in order to bring that conception with any great clearness before it—the sun in the center of the system, each planet with its satellite revolving about it. This

is a creation of the mind. The senses do not declare it in any way whatsoever. We do not see the solar system; we see simply planets, without discerning at all their relation to the sun. Indeed, the conceptions of the mind come in directly to contradict appearances. The senses have nothing to do with this action of the mind. We do not see the solar system—we conceive it. Or, take, again, the theories of chemistry in connection with molecules. A molecule may be more complex than the solar system—more complex in the number of bodies which make it up, in the relation which these sustain to each other, and in their varying hold upon one another. This whole conception, again, is a conception which came forth from the mind, the eye never so much as reaching the molecule, never so much as discerning that to which this whole theory pertains—far less discerning the atoms which make up molecules—still less discerning the relation of these atoms one to another. This whole idea, by which this system of molecules becomes as complicated as the solar system, is a creation of the mind. [Applause.]

IDEAS.

These are conceptions, due wholly to the mind, are furnished by it in obedience to certain suggestions, under certain ideas brought forward by itself. It is the ideas of space and time which lead the thoughts to the construction of the solar system. If the successive appearances of the heavens—the sensible data which the astronomer uses—were regarded by him as mere photographs, presenting certain points of light on a plane surface, there would be nothing in them to call forth a theory of their relations. It is because of the vast spaces in which they are thought to move, and the times occupied in this change of place, that the mind is started in the pursuit of a consistent theory. Atoms and molecules are accepted, and this connection with each other figured, because the idea of cause and effect is thus met and satisfied. Without this antecedent idea, we should have no impulse to the formation of a theory. Why does the Cardiff Giant so vex our thoughts? Why can we not pass it by as so much stone, with the same indifference that the dog regards it? Because of this notion of cause and effect, pressing us to form some theory of its origin. Thus, universally, it is some additional notion which the mind brings to external facts, that makes them fruitful—productive of scientific conceptions.

This use of ideas is a familiar fact of our daily experience. A man

is placed in a room, with which he is partially familiar, in which no light enters, and how instantly does the mind conceive the idea of space, and strive to construct things under it. He tries first to establish his present position, and then, by feeling along, to establish the relation between the first objects he meets, and so to construct them as to get an idea of their whereabouts. Passing from one portion of the room to another, he avoids this object and reaches that, conjecturally locating each according to his general conception. Thus one who has lost his rights takes up anew, in connection with trials, the external world, and finally acquires a skill which is astonishing and startling to the rest of us, who have not been accustomed to interpret these things in the form in which he interprets them. With the idea of time the geologist constructs the past physical history of the globe. He assigns long periods to the formation of strata, according to their thickness and material, and passes from one formation to another with varying intervals. His entire science arises under the motion of time, the time adequate to explain certain effects. The spectrescope discloses to us the nature of the sun, because of the idea of causation with which we interpret its luminous and dark lines. In the ideas, therefore, which the mind furnishes, we find the grounds and directions of knowledge. Some of these we indicate as affording the basis of a division between physical and mental science.

Existence.
Number.
Resemblance.

Space, Cause and Effect.	Time.	Consciousness, Spontaneity.

The first three of these apply equally to all things. We may be aware, through the senses, of an object before us, as this desk; but it is not till the mind supplies the idea of existence that we think directly concerning it. It is the sense of reality, of valid being, springs from the mind itself, not from the sensations as a sensation. The same is true of number. As a whole my hand is one; considered in reference to its fingers it presents four; in reference to their joints, twelve. In whatever way I look at it, a new numerical expression belongs to it. Of molecules, it contains an indefinite number. Of simple elements, or of homogeneous substances, a restricted number. Its length and breath and thickness vary in expression with the unit of measurement used by me; and thus I am

able, according to the method of contemplation, to find any one of a thousand numbers in this simple, continuous thing, the hand. Whatever we contemplate is one or many, as the mind finds it convenient to consider it. Number is but the pliant form of its own conceptions.

Having contemplated things as one or many, we regard them as like or unlike; and the notion of likeness, as a general and as a specific idea, is furnished by the mind. Two apples are like or unlike, according to the point regarded, like in color, unlike in form; like in form, unlike in flavor; like in qualities, unlike in origin. Thus the mind plays upon them, divides and redivides them, under the general idea of resemblance, according to the object it is pursuing. When, however, we come to the ideas of space and consciousness, the case is altered. These are not merely different methods of regarding the same things, they each give the peculiar and distinguishing feature of the objects to which they pertain. All physical events are characterized by the notion of space; all intellectual events by that of consciousness. We conceive of every physical event as happening somewhere. If it be a nervous, physical event, it happened in some brain. Eyes sharp enough and rightly placed would have disclosed it as a form of motion, as a change of some physical substance somewhere. When we come to mental facts the case is quite different. These must take place in some consciousness, in some one's experience. If no event has taken place in any consciousness, then there has been no intellectual fact. Mental phenomena have moreover no direct connection with space. The notion is not applicable to them. Thought has neither length nor breath nor locality. The action of the brain which accompanies thought, is not thought; that has a physical extent and position; can be seen and made by mind an object of outside inspection. Thus by adroit dissection and reflection, the mind might see itself think, if the action of the nervous system is thought.

By these two ideas, the phenomena of mind and the phenomena of matter, are cut entirely apart from each other. One is characterized by consciousness and the other by the notion of space. They are also cut apart still further, because all physical events come under the law of causation, all intellectual events come under the idea of spontaneity. The difference between cause and effect and spontaneity is very marked. In the case of cause and effect the force (and the word force is strictly applicable here) is always behind the effect. There is a certain amount of chemical action which belong to a cer-

tain fuel, and the fuel being given, no more action can take place than belongs to that fuel. The chemical action goes before and evolves the heat, the heat evolves a certain amount of steam, the steam lends a certain force to the piston, and that force goes directly to the labor that is in hand. Here the force is always realized, and just behind the effect, going into the effect. But in the case of spontaneity, the law of the mind, the case is entirely reversed. I start a proposition in Euclid, there is no chemical force or physical force of any sort that is bound to carry my thoughts just so far into that proposition. I spontaneously consider it. I, by virtue of my mental power, see into it, or by virtue of my mental weakness, fail to see into it. But the whole action is spontaneous, and there is nothing behind the mind, pushing the mind up into the inquiry a definite distance, there is no given amount of force. It cannot be said that I can think up to that exact point, or that I can feel up to my feelings in a definite degree, and no further.

Mental science thus lays down a double division between its own inquiries and those of natural science. The facts of the latter are found in space, and are subject to the law of cause and effect. Those of the former are found exclusively in consciousness, and are subject to the law of spontanity. That consciousness is a regulative idea, defining a class of facts, seems to us very plain. Compare it with time. Time is the condition of an event, not a portion of the event; something without which the event cannot be. Consciousness is the inseparable condition of a thought, a feeling, a volition; something without which these are unintelligible. If we try to regard consciousness as itself an art, a portion of the complex art of knowing, we are at once involved in confusion. Suppose every art of knowledge, as that by which I perceive the audience, to be double made up of an art of perception, and one by which the mind recognizes this as its own. If a first art cannot, in its very putting forth, be immediately known by the mind, how can a second art? This would seem to require another to reach and apprehend it, and this a fourth, and the fourth a fifth. Thus if the mind cannot know directly, know its own art for what it is, it cannot know at all; or if the mind does not know in this direct way the second art, why may it not the first, and thus dispense altogether with the second. If this view be true, and consciousness is a characteristic idea, there immediately follows therefrom the perfectly distinct character of physical and mental facts.

Physical and Mental Facts to be Inquired Into Separately.

Our inquiries must recognize this independent nature of the two fields, and must investigate each within its own bounds, and under its own conditions. No physical investigations can take the place of metaphysical pursuits. Neither can successfully override and displace the other. We find an illustration of an oversight of this fact in phrenology. There is nothing at all to indicate to the senses that the brain has anything to do with thought. We are no more conscious of our brains than of our hearts. If the phrenologist is to label a given projection on the brain, he must know some corresponding quality or power of the human mind. If he is to label a certain bump *memory* he must know that he possesses a faculty of memory, and he must know it by looking into his own consciousness. Then, finding that this is a power of the mind, he must look around to see if there is any projection on which he can fix his label. This trying to mingle two processes of physical and intellectual inquiry has some very ridiculous results, such as the notion of a power of *inhabitiveness*, as if we all "located" for the same reason! One man does not emigrate because he is timid, and another because he is patriotic, and a third because of family ties, and so on. And one might as well say that we have a bump for going down town because a large number go down daily, and that one class have a bump for going down town at ten, and another at nine, and another at seven! If we can say that given actions indicate certain powers, then there is certainly a tendency in human minds to go down town, and therefore there must be some bump to correspond! By this kind of reasoning there is no absurdity which cannot be reached. The phrenologist, before he can be a phrenologist good for anything, must be a thorough philosopher. He must have analyzed the mind completely, and then, as an after inquiry, he may ask what portion of the brain finds exercise in this or that power. A man cannot philosophize save in connection with consciousness. He can make no inquiry in the external world which will have the slightest significance, unless he makes a corresponding inquiry as to what is taking place in his own mind.

The Life and Thought Forces.

The idea of time belongs in common to the two classes of events, intellectual and physical. In connection with our thinking, a purely intellectual process, there goes on a series of physical events, happening locally in our brains. What was really proved to you by my

friend, Prof. Barker, a few evenings since? I should hold that the word "force" is better applicable to physical events exclusively, and that the word "power" might be advantageously reserved for intellectual events, so that, to speak of a thought-force, expecting to make it correlate with any physical force whatsoever in the brain, such as heat or electricity, is in entire contradiction to what has been urged here this evening. Among the forces that were presented to you then there was no place for a life-force or a thought-force. What was truly proved, as it seemed to me, was that there is a certain circle of physical-forces, which are complete in themselves, and replace each other constantly in definite quantity; and among these forces there is no force found which can be laid hold of as a physical-force, and which can be called a life-force. There is really no correlation of a life-force with the other forces. So in reference to a thought-force, those arguments tend to the conclusion that there is a circle of physical forces in the brain, among which we find no recognition of a distinct force, which can be called a thought-force. *And, for one, I should never look in any place in space to find a thought-force.* Supposing that we stood at one end of an ocean telegraph, and that the events there happening are represented to us by the physical events which occur in the body in connection with thought, and what happens at the other end represents certain intellectual events which keep constant time with the physical events happening at our end of the telegraph. We inquire into these events and we find a perfect circle of them, and that every one, when it disappears, is replaced by another. In the case of the telegraph, that would not be so, but when you consider the brain, there is nothing lost, for there is a complete circle of physical forces, without taking into consideration any thought-force or life-force whatsoever. That is to say, these physical events can revolve round and round, without any absolute loss on the part of any one of them. But that only goes to show how perfectly the thought-force is distinct from, and alien to, these physical events. We have at our end of the cable the events which are represented by the phenomena of the body, and at the other end a very distinct class of events, known as the phenomena of the mind. These phenomena stand in some mysterious connection with the phenomena of matter, but the phenomena of matter are, nevertheless, entirely complete in themselves. The two are distinct series of events, that run parallel, one with the other, but we do not and cannot discover the connection between them. The initiation of action begins some-

times on one side and sometimes on the other, now in the senses and now in the intellect.

The Superiority of Mind.

I urge, in conclusion, that if this view of philosophy is correct, then the mind evidently marks out all fields of inquiry, and assigns to every science its department. It says to natural philosophy, "You may work with the idea of space and the idea of cause." It says to mental philosophy, "You may work under the notion of consciousness and with the idea of spontaneity." I also urge, incidentally, that it is to mental science that we are to look for the verification of that action of mind by which the whole invisible word is reached. If we can verify the idea of cause and effect, may we not also, for our religious purposes, verify the idea of the infinite and the idea of right? The physicist must come to us for everything with which to build up the framework of science, and shall we not claim for ourselves the power of grasping at the infinite source of all things? It is pleasant, indeed, by means of the light, to look on the external world, but it is yet more pleasant to resolve the light itself into its first colors. It is pleasant to use the mind in understanding what is about us, but it is yet more pleasant to understand the mind itself, and the powers by which it establishes for itself those permanent hopes, without which all other possessions would be of little avail.

SCIENTIFIC LECTURE.—VI.

ON THE CONSTITUTION OF THE SUN.

By Dr. B. A. Gould of Cambridge, Mass.

The lecture was profusely illustrated by photographs of the sun, reflected with the aid of a lantern upon a background of white cloth. One of the photographs, showing spots and faculæ, was taken only a few hours before the meeting, by Mr. Lewis M. Rutherfurd, at his observatory, and was pronounced by Dr. Gould an excellent one. The lecturer was introduced by Prof. S. D. Tillman, Secretary of the Institute.

On coming forward, Dr. Gould was greeted with applause, and spoke as follows:

Ladies and Gentlemen.—It would be a vain task to attempt any investigation of the history of our early astronomical knowledge of the sun. Herodotus relates that Thales of Miletus predicted the total eclipse, which occurred in the year 584 B. C., during the sixth day of a battle between the Medes and Lydians, and which by its awe-inspiring influence brought their five years' war to a close. We know, too, that Pythagoras and his immediate pupils taught the doctrine, which he probably learned in Egypt, where he had studied, that the sun is the center of the universe, and that the earth revolves around him once a year. Three and a half centuries later, Archimedes correctly determined the sun's apparent diameter as between 27′ and 33′.

The determination of the earth's distance from the sun is a problem of peculiar importance, inasmuch as it is the unit in which, by means of Kepler's laws, all the planetary distances are measured. Consequently, all our knowledge of celestial distances (excepting only that of the moon) is closely connected with the value of this fundamental standard of measures; and any addition to our knowledge, which shows any one adopted distance to be too large or too small, demonstrates the same for all the rest. This determination is

made by the same means used by surveyors for detecting terrestrial heights and distances, by measuring the parallax—i. e., the difference of direction in which the same object appears from different points of view. Mars and Venus, as being the nearest to the earth, offer the greatest advantages for determining parallax, and many observations have therefore been made of these planets at two well determined points, distant from each other on the earth's surface. The base line between them being well known and the difference in direction in which the planet appears to the observers being carefully noted, it has been possible to compute the length of the other sides of the triangle, which gives us the distance of the planet, and thence can be deducted the distance of the sun, as we know the ratios of their mean distances to that of the earth. The actual mean distance of the sun, corresponding to the most probable value of the parallax is 92,380,000 miles; and since his apparent diameter at this distance is 32′ 3″ (somewhat more than half a degree) we readily find the corresponding true diameter to be of the collossal size represented by 861,232 statute miles. This is nearly 109 times that of the earth. So that the earth, if seen from the sun, would appear but little more than 1-12,000 part as large as the sun appears to us. The velocity of light in stellar space, corresponding to this value of the sun's parallax, is at the rate of 185,600 miles in a second of mean time.

To form some idea of the stupendous distances, magnitudes and velocities with which we thus become acquainted, let us compare them with some of those with which we are familiar. If we represent the earth by an ordinary rifle bullet, the sun would be represented on the same scale by a globe of four and a half feet in diameter at a distance of thirty rods; but if we denote the earth by an orange of average size, the sun would appear as a sphere twenty-five feet in diameter, half a mile off. We have seen that light, even with its inconceivable velocity, requires eight minutes, three seconds to traverse this enormous distance. An electrical signal, travelling with the speed usual upon our telegraph wires, would put a girdle round the earth in about one and three-fourth seconds, yet it would require one hour fifty minutes to reach the sun. A locomotive engine, moving forty miles an hour, would consume 263½ years in traversing the distance; and, could we suppose an iron bar to extend from the earth to the sun, a blow or pull given at either end, no matter how violently, could not reach the other extremity for more than 345 days, although vibrations are transmitted through iron at the

rate of about three and one-tenth miles (4,983 meters) in every second. The relative size of the sun is represented on the diagram, which represents in true proportion the disks of the larger planets and the orbit of the moon, traced on a circle representing the face of the sun.

The Sun's Weight.

The sun's distance and size thus being known, our next question has regard to its weight, or mass, as it is called, when very large bodies are spoken of. Here, too, we have abundant and trusty information, and it has proved easier to weigh the sun than to measure his distance. The weight of any terrestial object is simply the attraction subsisting between it and the earth, being measured by the force necessary to lift it. Now, by means of large masses of metal or other very heavy material, it has been found possible to exert a measurable gravitative attraction upon small objects, and comparison between the amount of attraction which a body of known weight thus exerts and that exerted by the earth, as shown by the weight of the object itself, gives us the actual mass of our planet. In this way the mass of the earth has been found to be a little less than 6,000,000,000,000,000,000 of metric tuns (of about 2,205 lbs. averdupois). One more step of the same kind enables us to compare the attraction exerted upon other heavenly bodies by the sun and the earth respectively; and it has thus been established that the mass of the sun is very nearly 327,000 times that of our planet.

We have seen that the diameter of the sun is about 108.8 times that of the earth. His volume or total size, therefore, is about 1,288,000 times, while his weight is only 326,800 times that of our planet. Consequently, he must consist of material fourfold lighter on the average than that of which the earth is composed, his specific gravity being on the whole about 1.38 times that of water.

Since the attraction exerted by a sphere is proportionate to its mass divided by the square of the distance from its center, it is easily seen that the weight of any object at the surface of the sun must be 27.6 times as great as the weight of the same object upon the earth. Anything let drop near the surface of the earth will fall about sixteen feet during the first second, but near the sun's surface, it will fall more than 444 feet during the first second; at the end of the next, it would have acquired a velocity equal to that of a cannon ball as it leaves the most powerful gun; and even if let fall at the height of two miles, it would traverse this distance in less than five seconds.

It was once thought that an exterior shell, surrounding the true body of the sun, was the source of his light and heat, and that within this shell was a comparatively cool, dark body, which might possibly be inhabited by beings not very unlike ourselves. Now that we know the case to be otherwise, and that the interior of the sun must be at a temperature surpassing that of the fiercest fires which can be produced by human art, the question of habitability loses its significance, except, perhaps, from a theological point of view.

But a consideration which might well have been borne in mind, is the vastly greater weight which all objects at the sun must exhibit by reason of the attraction of his immense mass. A man of ordinary size would there weigh nearly 5,000 pounds, and although we may hardly indorse the younger Herschel's statement "that he would be crushed as flat as a pancake by his own weight," we must concede that it would be a somewhat fatiguing exercise for him to run up and down stairs very often, and that the sun's surface would be rather a hard road to travel.

The Sun's Heat.

The sources of the light and heat of the sun, the only two of his marvelous properties apparent to the ordinary observer, are problems the greatest difficulty. I will only say here that the most vivid light developed by human art, when interposed between the eye and the sun, appears like a black spot upon the solar disk, the highest temperature yet produced by man is that evolved by the combustion of charcoal in oxygen, which Bunsen estimates at 10,000° C., or 18,000° F.; and this is about five-sevenths of the lowest reasonable estimate for the temperature of the solar surface. Coal burning at the rate of one pound to the square foot in about two seconds would attain this temperature, and Rankine has estimated that in the furnaces of powerful locomotive engines, a pound of coal to each square foot of grate surface is consumed in from thirty to ninety seconds, yielding a heat from one-fifteenth to one-forty-fifths as intense as that at the surface of the sun.

Adopting his estimate that a heat equal to that emitted by the sun might be attained by the combustion of coal at this rate of one-half pound per second to the square foot, it is easy to find how long the whole mass of the sum would last, were it composed of coal burning at that rate, and furnished moreover with an unlimited supply of oxygen to support the combustion. Performing the calculation, we find that the entire sun would be consumed in a little more than

4,000 years, that is within a period no longer than over which human history extends.

And now, what is this sun of ours—this center round which eight large planets, with not less than eighteen satellites and one hundred and nine small planets, are known to revolve, besides comets unnumbered and countless swarms of meteors; this luminary, whose fervent and dazzling beams radiate and have radiated for ages with a profusion which has shown no signs of failing, although the most vehement combustion fails to equal it in heat, and the most intense electrical action falls short of it in light; which, notwithstanding the enormous floods of energy which it is pouring out, has decreased neither in weight nor size to any extent which human skill has sufficed to detect? And does the realm of nature show any other object comparable with it in magnitude or in character? These are among the questions which force themselves on our consideration.

The sun is a star, apparently not unlike the most of those which gem the sky by night. This seems a better statement than to say that the stars are suns, although it would be difficult to give a good definition for either word. Our idea of a sun seems to imply that it is a center for a system of planets or satellites, dependent upon it for their light and radiant heat. There is some ground for believing this to be the case with some of the fixed stars, but for supposing it to be so with most of them there is no reason other than the supposed analogy; but that the sun is a star, one of the same great company which spangle the firmament, and indeed, one of the countless myriads which compose the single nebula which we see all around us like a ring and call the milky way, seems a well established fact. Here, as with them, that same law of gravitation holds unrestricted sway, which the double stars reveal to us as the guide and controller of their motions. Like many of them, it is variable in its light, although only to a small extent, and with a long period. Like them it is journeying through space, drawn by some powerful attraction, or performing a stupendous orbit around some center which astronomers have not yet succeeded in recognizing. Its annual motion has been computed by Otto Struve to be 150,000,000 miles.

And, notwithstanding its awful magnitude, we must still regard the sun as a comparatively small star, at least as not above the average size. This is proved by comparing his light with that of the very few fixed stars whose distance can be computed, and can therefore be compared with that of the sun.

When we view the sun through a telescope of moderate power, provided with a deep shade glass, or with a solar eye-piece, we see a bright disc, in which no measurement has yet detected any variation from a perfect circle. This circle is not of equal brightness, the central portion being much more brilliant than the parts near the circumference. Nor is the solar brightness equable in other respects, but the whole surface appears mottled by small variations in brilliancy, which have been compared to the irregularities upon the rind of an orange, and to the uneven surface of a stormy sea.

Spots on the Sun.

Usually, too, several spots, or groups of spots of irregular and often fantastic shape, are to be seen variously distributed, but almost always within a belt crossing the sun centrally, and not so wide as one-half his diameter. These spots differ in size from the smallest visible one to a breadth of 1′, which is one-sixteenth of the diameter of the sun, and corresponds to seven times that of the earth; and a short period of examination suffices to show that their forms and dimensions are undergoing continual and rapid changes. Ordinarily, and indeed, always, if of any considerable magnitude, they consist of two distinct parts, each sharply defined, viz.: A dark inner portion called the umbra or nucleus, and an extensive grayish border, much brighter than the nucleus, and called the penumbra. Sometimes, though not often, the sun is seen entirely free from spots, while at other times they are extremely numerous, more than fifty having been seen at one time. Not unfrequently they are visible to the naked eye through a smoked glass.

Finally, yet another appearance presents itself to the observer with a telescope of moderate power, viz.: Patches or streaks of light more brilliant than the rest, and not to be confounded with the general mottling of the surface. These are called faculæ, and are generally, but not always, of an elongated form, and chiefly manifest in regions near the limb or margin of the sun, where the fainter light, and some other causes, render them especially conspicuous. Faculæ may almost always be seen in the close vicinity of the spots, and generally to the left of them; but they are not restricted to these situations, and may be found in regions where spots are never seen.

Wilson's Theory.

To explain the phenomena of the spots, Domenic Cassini suggested, in 1671, that the sun's surface must be an ocean of light, surrounding

the dark and solid central body of the sun, and whose tumultuous agitation sometimes discloses some mountain summit which appears as the black nucleus of the spot. This suggestive idea formed, however, only a first step toward the solution of the problem, the honor of which belongs to a Scotch astronomer, Prof. Alex. Wilson, of Glascow, one hundred years later. Wilson observed that the penumbra or grayish border which surrounds the dark nucleus, and which is generally of about equal width on all sides when the spot is near the middle of the sun's disc, always became narrower on the side nearest the middle of the sun, when the spot approached the circumference. Hence he inferred in 1773, that the spots were funnel-shaped apertures in the luminous envelope, which disclosed the dark body of the sun at the bottom, and whose shelving sides constituted the penumbra. A moment's inspection of the diagram will show how such an aperture would at the middle of the disc exhibit the full size of the nucleus, D E, and an equable border, represented by the apparent breadth at C D and E F of the inclined sides of the opening; but that when it is nearer the circumference, as at A B or G H, the nearest side becomes foreshortened, as does also the nucleus, though to a less extent, while the farthest side of the aperture is presented much more fully to the view.

If, therefore, the appearances be as stated by Wilson, the inference seems irresistable that the spots are openings in the glowing envelope of the sun. To make sure of the facts in the case, the directors of the Kew Observatory have carried out an extensive examination of all the drawings and photographs of solar spots, which they could make available, and the enormous preponderance of observations in favor of this theory, must be considered as definitely settling the question. Mr. De La Rue also suggested the use of the stereoscope to decide whether the spots are actually cavities or depressions, with the same result. But this argument, although a strong one, can hardly be deemed conclusive—for our senses are tricky guides, and things are not always what they seem.

But why should the sloping sides of such a cavity manifest that diminution of the solar luster which the penumbra exhibits? Because the darker body of the sun would be partially seen through it, would be our first reply; but a moment's thought will show that were this the true explanation, the penumbra would exhibit different degrees of luminosity, and shade gradually away from full brightness at its circumference to darkness at its inner margin. This is not the

appearance; but the boundaries of the penumbra are sharply defined and its color is tolerably uniform throughout. To meet this difficulty the German astronomer Bode, assumed a second envelop of a cloudy nature, supported by an atmosphere, and situated between the true body of the sun and the atmosphere, as the outer light-giving envelop is called. The reflection of the photosphere from this surface would account for all the light of the penumbra, while the nucleus of the spot would be the body of the sun as seen through the opening in this second envelope. Twenty years later, the great William Herschel added the idea that the transparent, elastic atmosphere in which the stratum of clouds must be suspended, at a height of not less than 4,000 miles, likewise supported, and extended beyond the photosphere. Emanating from the true surface of the sun, this gaseous atmosphere streamed upward, displacing the material of the surrounding cloudy stratum and of the thinner photosphere. It is a curious fact that a hypothesis almost identical with this theory of Herschel had been propounded as early as the middle of the fifteenth century, before the existence of the spots was known to astronomers; yet this must be regarded rather as a fortunate guess than as a scientific theory, for the evidence by which alone such a view can be supported was not then known.

The general aspects of solar spots will be seen by the representations in the diagrams. The enormous magnitude of some spots has been already mentioned, huge chasms which cover an area of some two billions of square miles, and whose mouths would receive at once forty or fifty globes as large as our earth. Their continual and rapid changes of form and size, make it peculiarly difficult to settle many interesting questions concerning them, but decided indications of rotary motion have been observed in many of them, which would imply that they are turning like huge whirlpools around their own centers. The nucleus, although we speak of it as black, and although it appears intensely so in contrast with the glowing radiance of the surrounding portions, is in itself by no means devoid of brightness. It has been well said by Winnecke, that were the light of the whole sun to be extinguished, excepting the portion radiating from the nucleus of a spot, our eyes would scarcely be able to endure the dazzling beams. Herschel's estimate has generally been considered too low, yet it would give the dark nucleus of a spot a luminous intensity, nearly 2,500 times greater than that of the full moon.

A curious and frequent appearance is that of so-called bridges,

which often cross a spot, dividing it like partitions. Sometimes these are intensely brilliant, crossing penumbra as well as nucleus, while in other cases they are no brighter than the penumbra, and only perceptible when in contrast with the dark nucleus. Both their formation and disappearance have been frequently observed; tongues of light are seen darting across from one side, or from both sides toward each other, until the bridge is established, and in a way not unlike that which naturalists describe when microscopic organic forms are in process of development; and again they are seen to fade gradually away, growing fainter and fainter, until from an intense brightness they have seemed to dissolve and disappear. These also are depicted in the diagrams.

Frequency of Spots on the Sun.

In 1843, after Schwabe had carried on his spot observation for sixteen years, he discovered that their frequency was periodic, and he estimated the length of the period at about ten years. Subsequent observations have most fully corroborated this important discovery, and the accompanying tabular view presents a summary of the results obtained by Schwabe since the beginning of his series of observations.

Years.	No of groups.	No. of days.	Days without spots.	Years.	No. of days.	No. of Groups.	Days without spots.
1826	277	118	22	1848	278	330	0
1827	273	161	2	1849	285	238	0
1828	282	225	0	1850	308	186	2
1829	244	199	0	1851	308	151	0
1830	217	190	1	1852	337	125	2
1831	239	149	3	1853	279	91	4
1832	270	84	49	1854	334	67	65
1833	267	33	139	1855	313	79	146
1834	273	51	120	1856	321	34	193
1835	244	173	18	1857	324	98	52
1836	200	272	0	1858	335	202	0
1837	168	333	0	1859	343	205	0
1838	202	282	0	1860	332	210	0
1839	205	163	0	1861	222	204	0
1840	263	152	3	1862	317	160	3
1841	283	102	15	1863	330	124	2
1842	307	68	64	1864	325	130	4
1843	312	34	149	1865	307	93	26
1844	321	52	111	1866	349	45	76
1845	332	114	29	1867	312	25	195
1846	314	157	1	1868	301	23	101
1847	276	257	0				

In 1852, nine years after Schwabe's discovery Prof. Wolf of Berne, was led by careful study of the observations, in connection with ancient records, to a modification in the length of the period, which is now fixed at about eleven and one-ninth years. He also succeeded in proving that this period answered also to the variations in terrestrial magnetism better than that of ten and one-half years previously found by Lamont in Munich. Thus it became evident that the interval at which the phenomena periodically repeat themselves is the same for solar spots and for variations in the direction of the magnetic needle, or at least that any difference in the length of the periods is too small to be detected, and it is but natural that so remarkable a coincidence should suggest an identity of cause. Whether this is really so or not, we have no other evidence to decide.

GRANULAR SURFACE OF THE SUN.

About the year 1863, Mr. Nasmyth announced the discovery that with a powerful telescope of sharp defining power, and under favorable atmospheric conditions, the whole luminous surface of the sun appeared to consist of a thin layer of bright filaments shaped like willow leaves, averaging about 1,000 miles in length and 100 in breadth; that these lay scattered over the sun generally in every variety of direction, across each other, and that the black points were simply the interstices between these willow leaf filaments. This announcement stimulated at once to very minute scrutiny of the face of the sun, and to an active controversy among the observers. All agreed that the luminous surface was composed of bright particles, but Nasmyth's description found but little confirmation. One observer proposed the term rice grains, as better representing the form of the objects in question, and another compared them to gravel on the beach, and a third preferred the word granulations. The facts established have been very clearly set forth by Mr. Huggins of London. The granules are of various sizes, but may on the average be roughly taken as about 1½″ in length and 1″ in breadth, corresponding to about 675 by 450 miles. Some are nearly round, others oval, and others still almost without symmetry of outline. The coarser mottling of the solar disc arises chiefly from the alternation of lines or groups of closely aggregated granules and of regions in which they are less abundant. The points are the interstices between them, as they appear through a telescope of insufficient power. Mr. Huggins sums up most admirably by saying: "The phenomenon would be well represented if we

might suppose that the granules are recently condensed incandescent clouds; that they slowly sink, merge into each other, become less and less luminous, and gradually dissipate into comparatively non-luminous gas. The dark pores would then be represented by the portions where complete vaporization had taken place." He also gives an interesting diagram, which is here reproduced in a drawing by Prof. Morton, to show the distribution of the bright granules on those parts of the sun which are free from spots, in some of the most characteristic forms of their grouping. Thus it seems established that the luminous surface of the sun is entirely composed of these glowing particles or granules, almost as small as we can see, notwithstanding that they can scarcely be less than 700 miles in length, floating in a sea of darker though luminous fluid matter. The brighter and the darker mottlings of the ordinary surface, the brilliant glow of the faculæ, and the dimmed lustre of the penumbra, must alike be referred to the intrinsic splendor of individual granules, distributed in various ways, arranged more or less compactly and at different degrees of submergence in the fluid medium which supports them. Lockyer, a young English astronomer, who has done much to advance our knowledge of the constitution of the sun, says that he has seen the granules in the penumbra change their axial directions, and others, visible against the nucleus as a background, gradually to melt away. Chacornac says, moreover, that the granules, or crystals as he calls them, may be seen dissolving away like crystals of sugar before a jet of steam, becoming spotted over with dark points before they finally disappear.

Diminution of the Sun's Force.

The great fact, to which I have more than once alluded, that the sun is practically our only source of earthly power and energy, gives a peculiar interest to the question whether his brilliancy or thermal energy are undergoing any perceptible diminution. That they are diminishing we must assume on general principles, inasmuch as we know to what an inconceivable extent he is radiating force in the various forms of heat, light and chemical power, and force once emitted from a source of such superior energy is not returned to it again, while a new creation of force by natural agencies is just as impossible as a new creation of matter. But whether any diminution of radiant energy in consequence of the enormous expenditure is perceptible by our means of investigation is a most natural and important question, and to this it must be answered that no appreci-

able decrease has been detected. Few observations available for the purpose have been bequeathed us by the astronomers of former days; but from some careful observations made in 1801 by the distinguished astronomer Olbers, upon the brilliancy of Mars, which depends, of course, upon reflected solar light. Prof. Seidel, of Munich, was able to prove in 1859, that the solar light had not diminished in the interval to any measurable extent. It has been well said, that had some of the old Greek metaphysicians once dipped a thermometer in the Kissus, and recorded the date and temperature, it would have added a thousand fold more to our knowledge than all their speculations did. We can forgive them for this omission, if for no other reason than that they had no thermometers to dip; but had they ever recorded the average date of flowering of any common plants, we should be able to thank them for at least some materials whence we could deduce valuable geological and even cosmological knowledge.

THE SUN'S LIGHT.

In addition to the study of the quantity and intensity of light, two modes of investigating its quality are known to us. One is by discovering in what planes the luminous undulations occur, the other is by determining the proportion of rays each degree of refrangibility which it contains. By the first method, viz.: By the use of the polariscope, we are generally enabled to discover if light reaching us has been reflected, or directly emitted by the luminous body, and if that body is solid, liquid or gaseous. By the second, viz.: By the use of the spectroscope, we are enabled to analyze each ray of solar light, and to infer from what incandescent chemical elements it comes, at what temperatue it has been emitted, and through what forms of vapor it has passed. Few subjects are more fascinating than these, but I may not stop to set forth the processes involved, or to speak of the still active progress of discovery in these directions.

Thus far, ladies and gentlemen, I have endeavored to give you a sketch of the principal facts which have been discovered concerning the sun. Before asking you to give a very few moments' attention to a summary of the best received theories to account for the origin of his light and heat, and the probable length of time during which they have already existed and will continue to exist, I will say a few words on eclipses, and show you upon the screw various representations of them.

Eclipses.

The first sight which attracts attention when the last direct ray of the sun has been cut off by the advancing moon is this round orb in almost inky blackness against a luminous background, and the whole surrounded by a bright glory, which has received the name of the corona, or crown. This appears to have been seen in all total eclipses, for even ancient Greek authors mention it; yet the descriptions and representations of it vary in a remarkable degree. In some of the drawings it is depicted as a bright halo, concentric with the black disc of the moon, and of nearly uniform width; in some it is a glory of radiant beams; in others some of the beams or twice or three times the length of the rest; sometimes there are four, sometimes two, sometimes six such projecting beams of light. In judging of the degree of accuracy in these, there are many considerations to be kept in mind, such as—that the corona has only lately been made the subject of special observation; that the observations have generally been made through telescopes which magnified too much to allow the whole disc of the sun and moon to be seen at once; and that the sketches have almost always been made from memory at some subsequent time. I will show some of the representations which have been published, that you may more fully appreciate the diversity of forms assigned to the corona by different observers.

The "Chromosphere."

In the views of total eclipses which I have exhibited, you have probably observed another strange appearance, which is never absent though often vailed from the naked eye by the brilliancy of its background of luminous radiance. I allude to the excrescences from various portions of the sun's disc, which are most frequently seen as rose-colored, sometimes, however, deep red, clear white or even yellow. These are actually portions of the sun, and the moon in her motion gradually hides those in front of her, and discloses those which are on the other side. They are called the protuberances and it is only within the last two years that we have attained any definite knowledge of their character. They are not always even in apparent contact with the sun, but often seem to float like clouds above his surface, and assume many fantastic shapes, curved, forked, twisted and jagged.

But it was the spectroscope, which at this total eclipse of 1868 was for the first time directed to the protuberance, that the largest

additions to our knowledge are due on that occasion. By means of this wonderful instrument it was found that the protuberances are very unstable and variable in their forms, and in fact merely local aggregations of a gaseous medium which entirely surrounds the sun, and may at any time be detected by the spectroscope in any part of the limb. For this envelop, which is a real one, Lockyer proposed the name of "chromosphere," and its structure and chemical composition have since that time been the objects of continual investigation by numerous observers. It has been satisfactorily established that the light which it sends us is chiefly due to incandescent hydrogen, and usually contains indications of the presence of sodium, barium, magnesium, iron, and perhaps other metallic elements.

Mechanical Origin of the Sun's Light and Heat.

I will exhibit finally two photographs of the eclipse of last August, one by the Nautical Almanac party, with short exposure, and exhibiting but little coronal radiance, and one by the Coast Survey party with much longer exposure, and showing a very considerable glory round the sun. On this occasion I gave my own particular attention to the form of the corona, and the directions of prominent beams, and devoted a large share of the three minutes to measuring its dimensions and sketching its outline. Here are three drawings of its appearance at intervals of a minute, and I think they establish the fact that for the same observers, and at the same place, its aspect is undergoing continual variation. The facts being now manifest that the forces radiating from the sun cannot be due to combustion, inasmuch as this would be inadequate to afford the supply; and yet, that they must be in process of continual development from sources in which it previously existed in some other forms than as heat and light, since some amount of cooling and fading would otherwise inevitably be within the range of our detective powers, there remains but one explanation open to us out of all those which science can at present suggest. This is that the light and heat are the results of mechanical action, and that forces which were previously engaged in producing motion, are by the arrest of that motion, made to appear in this new form, just as iron grows hot under the blows of a hammer, or an axle takes fire in consequence of friction. From this inference there seems indeed no escape; but what is the motion which is thus converted? And where are the moving bodies, which are endowed with such mighty force, and are encountering such enormous resistance

as to evoke the tremenduous radiance of the sun from a previous momentum adequate to produce it. ?

Dr. Gould then gave an account of the meteoric theory of solar heat, and showed the objections which could reasonably be urged against it, and then proceeded to explain the theory of contraction, to which he gave his adherence, as well as in general to the theory of Faye, according to which the sun is a gaseous mass at a high temperature, the outer circumference being condensed by the extreme cold of the planetary spaces.

SCIENTIFIC LECTURE--VII.

THE COLORADO PLATEAU—ITS CAÑONS AND RUINED CITIES.

BY PROF. J. L. NEWBERRY.

The audience at the last lecture of the Scientific Course was numerous and appreciative. Prof. S. D. Tillman presided, and, in introducing the lecturer, said :

LADIES AND GENTLEMEN.—The lecture of this evening will terminate our course for this winter. The trustees have the satisfaction of knowing that every promise made at the commencement of the course has been literally fulfilled. They are fully aware of the diversity of the subjects discussed, and they have no doubt that more good would have been attained if a single branch of science had been presented, thus connecting the whole series of lectures. Such a systematic method cannot be followed effectively, unless the Institute owns complete philosophical apparatus, and gives the lecturer every facility for illustrating his subject before a large audience by means of diagrams and experiments. It is for this and many other reasons, that the members of the American Institute are anxiously looking forward to the time when it shall have a permanent abiding place in a magnificent structure commensurate with its wants and worthy of its name. [Applause.] Until that time we must be contented with the quarters we have. The trustees are gratified to find their example has been followed by officers of similar organizations in other cities, and that a new era has dawned since scientific lectures have become one of the fashionable attractions ; and present appearances indicate that the lecture-loving public will not rest contented until every department of science has been thoroughly set forth in the lecture-room. [Applause.] I have now the pleasure of introducing Prof. Newberry, of Columbia college.

Prof. Newberry, on coming forward, was warmly greeted with applause. He said:

Ladies and Gentlemen.—Some of you are aware that it chanced to me to be connected with parties sent by the Government to explore the proportions and topography of our own territory in the Far West. You know, perhaps, that our Uncle Samuel, as we some times call him, rather irreverently, has added very largely to his possessions, by purchase and otherwise, and that he has acquired it with such rapidity that he has been somewhat ignorant of what he has acquired, and it has been the object of the Government to send out parties to determine what their character was in regard to topography, mineral resources, &c. This series of explorations has been kept up for many years; and if the present acquisition of territory should go on we may suppose it will continue for years to come. For about five years I was connected with parties sent out by the war department, for the exploration of our western territory. During the five years of exploration there was very much that was interesting in our experience, and a great deal that was very severe and trying; and I have selected as the most interesting portion of the western exploration that which relates to the exploration of the great plateau which lies between the Sierra Nevada and the Rocky Mountains, or at least one portion of it.

This territory was explored by two parties with which I was connected; one of which, called the Colorado expedition, had for its object the determination of the navigability of the Colorado river. At that time we were carrying on war with the Mormons, and our army was in a vicinity slightly settled. It was then necessary to transport all the supplies to our army 800 miles by land, over from the east or the west. It was thought possible that the Colorado river, which was a large stream running from the interior of the continent, might be navigable; but this river was almost entirely unknown, both to our citizens and to the trappers, or to the Mexicans. There were various reports in regard to it—that it was an uncanny river, a very singular river, and that it was reported that there had been parties who were traveling and exploring in that region, who had come to its banks and had seen the water for days, and yet parched with thirst.

The report of the first expedition sent out by the war department to explore the course of the Colerado has been published, and has been, doubtless, seen by most present. Of the later Colorado expe-

dition no published narrative exists, inasmuch as the reports made by the chief of our party and the members of the scientific corps attached to the expedition are lying, where they have remained since the commencement of the war, in the archives of the war department. These, if published, together with the important reports of Colonel Reynolds and General Warren, on the country bordering the Upper Missouri, would be of much interest to geographers, and, if in possession of the public, would be of great economic value, inasmuch as they give minute and accurate accounts of a large portion of our country very little known, yet into which our people are rapidly, but, for want of the information these reports could furnish, blindly pushing their way.

The last of our Colorado expeditions was designated as the San Juan expedition, from the fact that its free field of exploration lies for the most part near or on the San Juan river—a stream almost unknown to the whites until we explored it, and yet a river as large as the Connecticut—whose banks once sustained a population of more than 100,000, now utterly solitary and deserted.

To enable you to fix in your mind the geographical position of the region I am about to describe to you, I will call your attention to this map of our western territories.

Here you see the Colorado discharging itself into the Gulf of California, while it rises in the Rocky Mountains 1,500 miles toward the north-east, a large stream but one whose length is disproportioned to its volume of water.

The Colorado has two principal tributaries, Green river, which rises in Wyoming, and crosses the line of the Union Pacific railroad, and Grand river, which drains the western portion of Colorado Territory. These, uniting in the south-eastern part of Utah, form the Colorado proper. From this point to the great bend of the Colorada, at the mouth of the Rio Virgin, is what is known as the Great Cañon of the Colorado, nowhere less than 3,000 and in some places 5,000 feet deep. Below the Great Bend the river runs through a low country, and one of the most singular in its topography of any that I have ever seen. This is a continuation of the great trough which is partially filled by the Gulf of California, lying between the Sierra Nevada, which composes the peninsula of Lower California on the west side, and the Black and Cerbat mountains, in Arizona, on the eastern side. This, for the most part, is a desert country; and here, just about the head of the gulf, lies the "Colorado Desert," as

it is called, a country raised but little above the level of the sea, consisting of low level areas covered with sand and gravel, which are the meshes in a gigantic net work formed of mountain chains that interlock in every direction. Here the giant cactus flourishes, and that group of prickly and repulsive plants that form the vegetation of deserts. The mountains of this region are volcanic in character, and are destitute of vegetation, but the rocks which compose them assume the most picturesque forms, such as domes, spires, and other architectural figures, and exhibit the most varied and strongly contrasting colors. The Colorado traverses these mountains through fissures which it has cut in them from summit to base.

In our exploration of the lower Colorado, we employed a steamer constructed in Philadelphia, and which was put on the river at the lowest stage of water. That was in mid-winter, for the Colorado exhibits the same alterations of level that the Nile does. In the summer it flows with a full and rapid stream, formed by the melting of the snows of the Rocky Mountains, and is fifteen feet higher than in the winter. We chose the time when the water was the lowest, so that the difficulties of navigation should be most apparent.

After leaving Fort Yuma we entered a *terra incognita*, nothing being then known in regard to the country above that point. We started with sixty days' provisions, leaving the larger half of our party at the fort to await our return, as we expected soon to encounter insurmountable obstacles; but, at the end of the sixty days, we had navigated the river 500 miles, and had not yet reached any impediment that was absolutely impassable. The boat with which we navigated the river was ingeniously contrived to be unfit for the purpose for which it was intended, inasmuch as it was very narrow and drew three feet of water, when it had the requisite fuel on board for half a day's run. Those who know anything about the navigation of western streams are cognizant of the fact that boats of great capacity are constructed to run on twelve or fifteen inches of water; but ours drew three feet, and we experienced unnecessary difficulty and delays in getting over the rapids and shoals we encountered.

When near the Great Bend we came in sight of a range of mountains, which in its aspects, and in the character of the cañon which traverses it, is a fair example of the scenes that we passed through. Day after day as we traveled along, we had seen before us a mountainous wall which seemed to block or way. This was generally of volcanic rock, and almost always of various bright colors, as red,

green or yellow, and bearing domes and pinnacles of the most fantastic shapes. As we approached, we found a way opened to us, and we sailed freely and quietly through, for each of these mountain chains was traversed by a cañon cut by the river. At the point to which I have brought you in my story, there appeared before us a more formidable chain than any we had encountered, named by Lieut. Ives, from its predominating color, the Black Mountain range. It was on Saturday morning, the 7th of February, that, having toiled up some rapids, just below the cañon we came to a great gate, of which the walls, composed of red porphyry, rose a thousand feet on either side. As we entered this grand portal we came into deep and still water, and a panorama opened before us so peculiar and enchanting that all the party soon became absorbed in the scene before us.

By means of the small boat the canon was traversed twenty-five miles up to the point we aimed at, the mouth of the Rio Virgin. We then returned down the river 150 miles to meet our supply train and find a point where the mountains lying east of the river could be crossed.

Passing the Black mountains we came down on a plateau 800 feet higher than the valley of the Colorado. This was twenty miles wide, and bounded on the east by the Cerbat mountains. Crossing the Cerbat range we descended to another plateau 2,200 feet above the river. On the other side of that another range of mountains, east of which was the great plateau of the central portion of the continent, and it was to bring you safely up to that high table land that I have led you by such a long and round-about course, and have tried your patience with the details of our progress.

The Colorado plateau is traversed from side to side by the Colorado river, which, throughout all its course through the table lands, runs from 3,000 to 6,000 feet below the general surface, in a gorge cut out by its waters, known as the cañon of the Colorado, one of the most remarkable topographical features on the earth's surface. Probably nowhere can be found a more striking and impressive scenery than that formed by perspective lines of the Mesa walls which seem almost hanging in mid-air, and the profound abysses of the cañons, which open in yawning chasms a mile in depth at the very feet, as it were, of the unprepared and awe-struck traveler.

A still higher interest attaches to the Colorado plateau from the fact that it was once the home of a large and partially civilized people, whose stone-built structures, habitations, citadels and towns are

scattered over its plains, or crown its castellated crags, but now, almost without exception, abandoned and in ruins.

At the present time the Colorado plateau is, for the most part, a hopeless desert; but it was at one time as fertile and beautiful as any portion of our country.

On the north-eastern side of the plateau the Rocky mountains, where broadest and highest, rise from it as a base. These, acting as a great condenser, cause a copious precipitation of moisture, and supply the water which forms many great rivers, as the Arkansas, Red river, the Rio Grande and Colorado.

To resume the thread of my narrative where it was broken for this digression. When we had ascended the western margin of the high plateau, as our special business was to trace the line of the Colorado in the Great cañon, we struck north-easterly to reach it again. When still many miles distant from the cañon, we found the plain so cut up by ravines opening northward, that we were compelled to descend to the bottom of one of them, and take that as our road. Where we descended, the cliffs were about 500 feet high, and at the bottom was a spring, and—what caused us no little surprise—a peach orchard. This was in north-western Arizona, several hundred miles from any Spanish settlements; yet, during the many, many years that the scattered Indians of this region have been trading with or robbing Mexicans, they have passed from hand to hand, from tribe to tribe, various luxuries of civilization, until they have penetrated the most inaccessible portions of the interior. Peach stones are easily transported, and, through the agricultural "Pueblo" Indians, they have been generally disseminated over the table lands of New Mexico and Arizona, as we subsequently often found peach trees growing about springs along the routes of travel.

Near the mouth of the Little Colorado we attempted, in the same way as before, to penetrate to the bottom of the Great cañon, but this time without success; for, though we descended nearly to the river, and carried down a barometer to a point only 1,500 feet above the level of the sea, then we were stopped by a precipice we could not pass. The cliffs overlooking the cañon of the Colorado at the junction of the Little Colorado with that stream are, as we subsequently learned, 8,000 feet above the level of the sea; and as the river there is about 1,500 feet above the sea, the walls of the canon are more than a mile in height.

The cañon of the Little Colorado we found utterly impassable,

and so we were compelled to "head" it, making a detour of 200 miles, passing around the San Francisco mountain, a great extinct volcano, which crowns the table-land in Central Arizona.

Crossing the Little Colorado above the falls, we sought and found the Moqui Villajos, on the high plateau, sixty miles north of our crossing. These Moquis are the only pure remnant of the ancient civilization that once covered the Colorado plateau, and as such, were objects of special interest to us. We were the first whites who had come among them "taken notes;" and their towns, well built, of masonry, perched on cliffs 500 feet above the plains they cultivate. Their physiognomy, habits, domestic economy, their arts and religion formed the subjects of our study for several days.

We stayed among these people a very long time, and studied their habits and manners, and endeavored to get from them as clear an idea of our ancient civilization as possible; we noticed an interesting fact bearing upon their theology in the conduct of those who went with us. When we came to a spring, our guides first went and made an offering by scattering some of their corn meal around on the water, then cotton was tied to a stick, and made to depend into the water, which would, of course, by capillary attraction, rise in the cotton. When this happened they concluded that the spirit approved their presence there, and permitted them to drink These Indians are also very ingenious in the cultivation of the soil and in the manufacture of their fabrics. Their industry is spread over the surface, and evaporated again and again to irrigate and vivify the whole, but on the western border of the plateau the descent is very rapid to the sea level. So that when the Colorado reached that part of its course it fell almost in one cascade 5,000 feet (and from the base of the mountain 8,000 feet). In this descent it developed a power that sufficed in time to excavate the stupendous chasm in which it flows, and to cut through the entire series of sedementary rocks from the top of the chalk formation down through all the underlying formations to, and the lower part of its course, 800 feet into the solid granite.

From the Moqui towns we struck north-westerly, and attempted again to reach the cañon of the Colárado. The dryness of the high table land over which we traveled was, however, such that we were compelled to turn back for the want of water; and as our animals were nearly broken down, and our resources generally exhausted, we pronounced the Colorado expedition ended, and passing through the Navajo country to Santa Fe, came home across the plains.

At the conclusion of the lecture the Rev. Dr. Barnard, President of Columbia college, after a few words expressive of gratification at the success which had attended the course of lectures, offered the following:

Resolved, That the thanks of the audience are tendered to the American Institute for the interesting and instructive course of scientific lectures which has just closed, and that the trustees of the Institute are requested to make arrangements for a similar course of lectures to be delivered next winter.

The resolution was unanimously adopted.

PROCEEDINGS OF THE FARMERS' CLUB.

RULES AND REGULATIONS OF THE FARMERS' CLUB OF THE AMERICAN INSTITUTE, ADOPTED BY THE COMMITTEE ON AGRICULTURE.

1. Any person may become a member and take part in proceedings, by conforming to its rules.

2. The officers shall be a President and Secretary, to be chosen by the committee, in April, and hold for one year, and until successors are chosen or appointed. In absence of President, a chairman *pro tem.* shall be chosen by the Club.

3. Any member, for disorderly conduct, may be expelled by a vote of a majority present.

4. The Secretary shall keep the minutes of the Club and have control of the same.

5. The President may at any time call a person to order and require him to discontinue his remarks.

6. The meetings of the Club shall be held every Tuesday, at one o'clock P. M., and continue for two hours, unless otherwise determined.

7. Discussion shall be confined to agriculture, horticulture, pomology, and subjects connected therewith, and what relates to rural improvement.

8. All members of committees shall, so far as practicable, be members of the American Institute.

9. Questions or inquiries shall be made through the chair, but answers must be brief, and not lead to debate.

10. Any person desiring to speak shall rise and address the chair, and avoid personalities, and confine his remarks to the subject before the meeting; and the vote of any person may be challenged, unless a member of the American Institute.

11. No person shall speak more than twice on the same subject, or occupy more than ten minutes, unless by a consent of the meeting.

12. Particular subjects may be fixed upon for any meeting, and in that case, shall be taken up for consideration at two o'clock.

13. The usual parliamentary rules shall govern when not provided for by these rules.

Members of the American Institute are members of the Club.

May 4, 1869.

The regular session of the Club was held on Tuesday at one o'clock P. M. Nathan C. Ely, Esq., the president of the Club, called the meeting to order; Mr. John W. Chambers filling the post of permanent secretary.

Maple Sugar.

Mr. N. T. Jackson, Spring Mills, New York.—In the first place, let me tell how common or black sugar is made. Wooden buckets are generally used, and if not new, they come in from the sugar camp sour and dirty; they are stored away without washing till the next spring, then a little cold water is thrown in, a few flourishes made with an old broom, then rolled a moment in a kettle of hot water, the process being just slack enough to soak, the old sap into the staves. A huge gash is made with an ax or bit, an old wooden spile inserted, that perhaps never was washed, or an old rusty iron spile no better. The arch, if any, is a poor one, no grates to put the wood on, no cast front to keep the fire away from the pan. The fire streams up at each end, burning on the sap. It foams up, takes in the burned, and as it grows sweet, looks red and redder till sirup, and then it is black. No wonder; everything to make it so. My plan is to use none but tin buckets, and galvanized pans and spiles. Everything is carefully avoided that tends in any way to discolor. The sap is all strained before it comes to the pans, and all the scum that rises while boiling is skimmed away. The fire is not allowed to come against any other part but the bottom of the pan. I have a cast front to the arch, a cast strip between the two pans for them to rest on. If we have no rains in the sap I am sure of as nice sugar as I send. It will be white if kept from being discolored by rain, leaves, bark, or burning. White sugar cannot be made in a kettle. It will burn on the sides in spite of any painstaking. I have been accused with putting flour with my sugar to make it white. I usually make several hundred pounds of very light colored sugar; this year 1,100 from 300 trees. We sugar off in a small pan on the stove about twenty-five pounds at once. I do not cook away very hard; stir in a wooden bowl—cake in wooden boxes. The sooner the sap is converted to sugar the whiter it will be. A hot sun will turn it red in a day. I have a half-inch bit at first, then freshen the bore with a rimmer, made the shape of a spoon, only more pointed, and the sides straight. Freshen as often as once

in a week. More sap can be had and the trees hurt less. We clarify with the whites of eggs—two eggs to twenty-five pounds.

Mr. Solon M. Daboll, North Stephentown, New York.—I send you a small specimen of the stony substance deposited from maple sugar during the boiling process. The trees which produced it grow on a Falcon slate soil. The amount produced is about the same one year as another, but the sap which runs last in the season has a much larger quantity than the first run. The specimen was scraped from a pan used for sugaring off.

Mr. James A. Whitney.—This brown powder consists mostly of a compound of lime, which is found in most hard wood sap with malic acid. The advancing heat of spring develops more of this acid in the sap, and the formation shows that the sugaring season is nearly ended. There may be some magnesia in it. It does little or no harm.

To Keep Maple Sugar.

Mr. G. K. Edgerton, Wheatfield, Michigan, has sent this recipe to keep maple sugar: "The main point is not to overdo in sugaring off; better take it from the fire and have it drain a little; spread out until it dries, and then pack away from smoke and bad air." He has kept sugar in this way for two seasons.

Lodi Poudrette.

Mr. R. B. Bartlett, Kingston, N. H.—Can some one of your numerous members give me any information in regard to the double refined poudrette, manufactured by the Lodi Manufacturing Company, N. J. The company say it is equal to the best super-phosphate, and they offer it at thirty dollars per ton in Boston. I have never heard of its being used in this section, and so I thought I would inquire of the Club, thinking some of your members may have used or seen it.

Mr. James A. Whitney.—I have of late made a careful investigation of the qualities of this fertilizer. It is dried night soil, robbed of its foul odor by carbolic acid. In the "double refined" this is mixed with the decay of refuse from slaughter-houses. It is lively, stimulating manure, acts at once, and is suited to short seasons and quick-growing crops. It has more ammonia than phosphoric acid, and will grow leaf, stem, and stalk better than ear or head of grain. It ceases to act with vigor in six weeks or two months after application, and does not give lasting value to the soil, but urges crops forward in May and June

The Lake Climate for Fruit.

Mr. S. L. Deyo of Naples, near Canandaigua, N. Y.—I wish to have read and published by you, if consistent, a statement of the products of the town of Naples. This is for this town alone, and does not include the vast amount of fruits and vines around the head of Canandaigua Lake. The vines given here are nearly all young, and one-half or more too young to bear in 1868.

Bush. apples	25,405
Bush. peaches	2,441
Bush. plums	1,416
Bush. cherries	404
Bush. pears	71
Lbs. grapes	553,453
Acres grapes	382
Bush. quinces	27
Bbls. cider	499
Lbs. dried apples	22,186
Lbs. dried peaches	2,412
Lbs. dried plums	4,659
Lbs. dried cherries	552
Galls. wine	14,689
Cans fruit	6,795

Ashes, Chemically Considered.

Mitchell Bros., New Haven, Conn.—Will you be kind enough to inform us through the Chemist of the Farmers' Club, how many pounds of carbonate of potassa are contained in one bushel of ashes?

Mr. James A. Whitney.—When reference is made to the value of ashes as a fertilizer or for soap, the wood from which they were produced should always be mentioned. Of trees commonly used as fuel, none contains so much potash as the elm. Beech is rich in potassa, and so is walnut. Pine, on the other hand, contains so little that its ash is not worth saving. Oak has eight per cent of potassa but a large amount of lime. Ashes vary in weight with the moisture they contain. If a bushel weighs twenty-five pounds, one buys in it from two to five pounds of carbonate of potassa, when the wood was hard. For agricultural uses oak wood ash is as good as any on account of the lime it contains; for potash, elm, beech, birch and maple should be chosen.

Leaves of Rhubarb Fatal to Hogs.

Mr. Wm. P. Passmore, Fairville, Chester county, Penn.—Your Club may be interested in the last experiment I have tried in feeding

hogs down here in Delaware. On last Friday, the 23d, we prepared, among other marketing, twenty-five bunches of common rhubarb, a pie plant, by stripping the leaf from the stalk, which we sent to market. The leaf being rubbish, we threw it into the hog-pen, where we had nine Chester county whites, that would dress about 100 pounds each. The result this morning is, that of the nine pigs five are dead, three appear convalescent, and one looks very doubtful. These pigs died with every symptom of poison.

RATS AND MICE PROOF HOUSES.

Mr. James M. Hartwell, Colebrook, Coos county, N. H.—After the frame of the house is up and boarded, and the partitions for the rooms are set, take same mortar and bricks and lay one or two thicknesses of brick between every stud, both on the lower and upper floors. Then lath and plaster to the floors, and put on a narrow mop or washboard, not so high as to have the upper edge come above the brick. As the rats and mice gnaw in, just over or under the washboards will be rat and mouse proof, at an expense of five dollars.

PROFITABLE HENS.

William C. Noyes, Lebanon, Conn., gave the following relating to the productiveness of his hens for the last two years:

April 1, 1867, to April 1, 1868:

Twenty-five hens—220½ dozen eggs	$66 66
129¾ pounds poultry	28 27
Total	$94 87

Average per hen, $3.79½.

April 1, 1868, to April 1, 1869:

Thirty hens—247⅔ dozen eggs	$87 05
92½ pounds poultry	22 05
Total	$109 10

Average per hen, $3.63⅔.

STRIPED BUGS ON CUCUMBERS AND SQUASHES.

Mr. Robert Kinnicut, Warren, R. I., would learn how to keep these pests from cucumbers and Hubbard squashes.

Mr. D. B. Bruen stated that he had used Scotch snuff.

The chairman said he had used a brood of chickens and a lot of toads.

Dr. Isaac P. Trimble had also found that toads and chickens did a great deal of good; but he would recommend boxes to be placed over the hills. It did not make any matter about covering them. Let them be some four or five inches high. He thought that as the bugs came in flights, these coverings would keep them out of sight of them, and therefore they would pass over.

A member.—I have tried them and found them of no use.

Mr. J. C. Thompson, Staten Island, said that he found out accidentally that the bone dust made by the Boston Mills Company was a sure preventive. The plants should be dusted with them when the dew was on, and the application repeated several times, till the vines are vigorous.

Ground Hay.

Mr. Joseph S. Kirk, Pittsburg, Pennsylvania, sent a specimen of ground hay for food for cattle. He says that ten tuns a day can be ground, at a cost not exceeding one dollar a ton. Ground, it resembles ground oats, its weight being from thirty-two to thirty-four pounds per bushel. Mixed with chop feed, such as corn or oats, it makes a cheap and excellent food. He wished to know the relative value of good bright hay as compared with oats of equal weight. A member said that three pounds of hay are equal to one pound of oats.

Failure in the Corn Crop.

Mr. L. H. Albertson, Delaware Station, New Jersey, writes:

"During the last few years, in the northwestern part of Warren county, New Jersey, where I live, there has been considerable failure in the corn crop. The corn comes up very unevenly with regard to time; that that comes up latest looks feeble and unhealthy, and by the time of the last plowing is not more than six inches high, the ends of the leaves dying, and on being pulled up, only a few slender roots are found near the top of the ground. As the ploughman says, the worms have eaten the main roots off. There are various and conflicting opinions advanced as to the cause of this condition of corn, without having made minute investigations. Some attribute it to lime, some to timothy sod, and others say (as there is here and there a good hill among the poor patches) there must be worms in the corn. There is not that much difference in the ground. I have made repeated examinations by taking out the whole hill, roots and all, and

washing the earth carefully out of the roots, and have always found the main root on, with the shell of the grain planted, but the space from the old grain up to what was then the lower end of the stalk, dead, while the root below the grain, alive, and a few slender roots near the surface of the ground. Good hills taken up the same way, the main root was found to be alive. I have found from two to six of the large white-bodied, small brown-headed grub worms, as they are called, in the decayed vegetable matter among the sods about the good hills, and near a pint of the excrement of the worms, as black as the decayed vegetable matter upon which they apparently fed, but not one root that showed signs of being eaten off. But not in a single case have I found any worms about the poor hills; and a good reason, I think, is that the there has been but little or no sod on the ground, and no decayed vegetable matter for them to feed upon, as I think that is their subsistence: for we frequently find them in chip-manure and old rotten wood. What is the cause of this?"

Dr. Trimble thought that plenty of barn-yard manure would avail.

Mr. A. S. Fuller said that it was what is called the corn worm, a new insect, named last year by Mr. Riley, of Missouri. It is about a quarter of an inch long, and if the gentleman will look closely at the sprouts, he will find these small grubs. Probably by dipping in tar water, or something of that kind, before planting, it would keep them off. It is a species of the onion grub.

MANAGEMENT OF MILK, CREAM AND BUTTER.

Mr. L. Breckenridge, Toronto, Canada.— I take the liberty of inquiring what is considered the best method of keeping milk so as to produce the greatest quantity of butter; if there is any better way than in a cellar; and if not, how should a cellar be constructed to be best adapted for the purpose.

Dr. Isaac P. Trimble.— This gentleman cannot have a better model than the practices of those farmers in Delaware and Chester counties, Pennsylvania, who make the famous Philadelphia butter, which sells the year around at seventy-five cents a pound. I had the pleasure last summer of acting on a committee with a number of gentlemen who visited those farms. The report we made has been copied very widely, and the Commissioner of Agriculture has put it in his report. We there saw the finest of butter made without water. Most of the dairies, it is true, were furnished with fine spring houses; but cold water is not indispensable. Marshall Strode,

for instance, has a deep, narrow cellar or vault ten feet below the surface, walled, plastered and frequently whitewashed. The pans are placed on a low stone platform, built on three sides of the vault. This shelf is broad enough to take two pans abreast. Such is the depth of this vault that in midsummer the mercury does not rise above sixty degrees, and generally not over fifty-five degrees. We were there on the afternoon of a hot, sultry day in July, and in this vault ice melted very slowly. This cellar is sacred to cream. Nothing that can in any way defile or taint the air is ever admitted. The floor is kept religiously clean. Lime is used to kill any acid that might come of a few drops of milk spilled. The cream is kept in large cans, and stirred when a fresh skimming is added. The skimmer is perforated with a great number of small holes, so that no milk or curd is mixed with the cream, not a gill perhaps in a half barrel of cream. The night before churning, lumps of ice are put in the cream cans, and the temperature thus kept low. Churning is done in an open shed, in a large revolving cylinder. The cream is at sixty-two degrees when the churning commences. Just as the butter begins to come, a large pail of ice water is thrown in, and the churning finished at a temperature not much above forty degrees. This chilling of the butter when the granules are forming, before the gathering takes place, Mr. Strode considers of great importance in July and August. As soon as worked the butter is returned to the vault, and never, from the time the milk is strained until the butter is sold, does either milk, cream or butter become warm. The temperature is most of the time about sixty degrees, and often, by the free use of ice, reduced nearly to forty degrees.

Those farmers a few miles southwest of Philadelphia know how to make money with cows. One we saw, an old gentleman, easy in circumstances, living on twenty acres of good land, keeps only four cows, but they are *good* cows. The family consists of six persons. Yet after they eat all they want, he sells $500 worth of butter a year, all from these four animals. He says the secret of profit from cows is to get them to eat just as much as possible. He has three ranges of pasturage. In the morning they browse on clover. In the afternoon they range over an old pasture of firm sod and fine green grass. Toward evening they loll through a field where the trees were recently cut, and find a choice juicy bite of tender grass near a stump, or in the edge of a clump of bushes. In this way they come home full as they can walk every night. In the fall he begins to give grain, adding a little each week as the autumn lowers.

FOOD FOR BEES.

Mr. R. M. Watson, Clayton, N. J., wanted to know if there was anything better for bees than buckwheat.

Mr. Fuller mentioned the raspberry, linden tree and white clover.

CURE OF SICK ANIMALS.

Mr. H. T. Whipple, Long Hill, Stearns county, Minn.—I wish to inquire of the Club if any member can tell me what ails the horses described below. A fine young animal, after a sharp pull, is taken by a sort of cramp in her hind parts, draws her hind limbs under her, moves them uneasily, with a sort of kicking motion, at the same time advancing them until her four feet are together, and she is nearly in a sitting posture; she seems to be free from any sharp pains, and, in fact, has no other symptoms. Another, after being fed several days on immature corn, would lie down, both in and out of harness, at every opportunity; no other symptoms. Two others were suddenly taken with a desire to lie down in harness, but they were uneasy, stamped their feet, changed from lying to standing often, and acted as if something was irritating their legs, but nothing could be seen; the attack did not last long, was not colic or bots, as they would eat freely, and manifested no pain except the irritation above named. Can any member, from the above symptoms, name the complaints, give a remedy, or tell whether they have any connection with each other.

Mr. Peter Shippman, Lexington, Minn.—Very much valuable information I have obtained by carefully reading your proceedings from time to time, and have, therefore, concluded to ask a little information of you myself. As I reside a long distance from any veterinary surgeon who has any reputation at all, I would ask: First, whether a horse with the poll evil can ever be cured entirely; second, whether there is any remedy you could recommend to cure the poll evil; third, where, and under what title, can a good book be had which explains and treats on diseases of domestic animals in a plain manner. By answering any or all of the questions through the Tribune, you will confer a great favor.

ANSWER BY PROF. JAMES LAW, OF CORNELL UNIVERSITY.

It is impossible, from the description given, to arrive at any safe conclusion as to the malady affecting the first mare named by Mr. Whipple. Her movements point to the presence of abdominal pain, but what its source may be does not appear.

The three others, that fed on green corn, are suffering from indigestion, and will be relieved by opening the bowels and changing the diet. To secure the first named object, give to each four or five drachms of Barbadoes aloes. Allow them to drink at will of water with the chill taken off, and give no food but sloppy bran mashes until the purging has ceased, when they may be gradually restored to a diet of sound grain (oats preferable) and hay.

In answer to Mr. Shippman's queries, it may be stated:

First—That the milder forms of *poll evil* can be thoroughly cured, while in the more severe cases, though a cure can be affected, the part is greatly impaired in structure, and there is a constant tendency to its recurrence on the slightest possible cause.

Second—As soon as the presence of matter can be detected by its fluctuation, a free incision should be made to evacuate it. Either this or another opening should be made from the lowest point of the sac, in a downward direction, toward the surface of the body, so that all matter may run off as soon as formed. If, with this, the head is kept in an elevated position, the milder forms will get well. In the severe forms, the sac should further be injected twice or thrice a week with a solution of one scruple of chloride of zinc to a pint of water. In the worst cases, with extensive destruction of the ligaments or bones, further surgical interference is wanted; but as this could only be undertaken by some one intimately conversant with the anatomy of the part, it would be useless to refer further to it here. During the progress of treatment everything should be done to secure vigorous health in the patient, and especially to keep the bowels moderately active by occasional sloppy bran mashes and roots. In no case, during treatment, nor in any but the very mildest, after recovery even, should the animal be allowed to feed from the ground, or to keep the head, from any cause, habitually at a lower level than the body.

Third—A good book on the diseases of the domestic animal is at present a desideratum. "Gamgee's Domestic Animals in Health and Disease" is, so far as it goes, perhaps, the best extant. It is published by Maclachlan & Stewart, Edinburgh, and Simpkin, Marshal & Co., London, and may be obtained through any bookseller.

How to Tame a Bog Meadow.

Mr. O. Snowberger, Quincey, Pa.—We have a spot of meadow upon which rough grass has grown probably for forty years. Some five years ago I spread thinly over it some natural ground, dragged

it down with a pile of brushes, and sowed grass seeds. Two years ago I gave it another spreading of natural ground, and have kept throwing on grass seeds. When I now walk over the piece I discover a remarkable change. Some places there is nearly all new grass; some places about the half; some places about the one-fourth; in others it remains nearly all wild. In part the change has been effected by watering.

Adjourned.

May 11, 1869.

Mr. NATHAN C. ELY, President of the Club, in the chair; Mr. JOHN W. CHAMBERS, Secretary.

NEW TEXTILE PLANT—THE RAMIE.

Mr. Frank M. Fowler, of St. Bernard county, California, made some inquiries touching this new textile fabric, and was especially anxious to know where the seed could be procured, as he desired to test it.

Mr. J. W. Gregory replied that there are as many different kinds of ramie as of cotton. The former is propagated from roots, and Mr. Gregory said he knew no party excepting Mr. J. Buckner, of New Orleans, who could comply with the inquirer's request. Mr. Buckner has plants of fine texture and they can be purchased at moderate rates. Mr. Gregory remarked that he himself had lately procured a few plants for experiment.

Mr. J. Buckner, of New Orleans, La., sends to the Secretary the following information in relation to this new plant:

This new textile, lately introduced to southern agriculturists, is a native of the island of Java, and was first brought to Europe for investigation in 1844, where it received the botanical name of *Boehmeria Tenacissima*, and by the beauty and strength of its fibre attracted much attention in manufacturing circles. Since that time every encouragement has been given to producers in the East Indies to induce them to cultivate ramie in sufficient quantity to supply the demand; the result is that a considerable quantity is annually received in Europe and manufactured into fabrics of the finest quality, excelling in strength, beauty and finish, linen of the finest texture, and rivaling even silk in lustre.

Since its introduction into the United States in March, 1867, it has excited much interest among European manufacturers. They con-

sider the fibre of the *Boehmeria Tenacissima*, superior to that of any other textile plant, and very valuable for manufacturing purposes; the supply from the east is entirely inadequate to fill the demand, and unequal to the fibre here produced, in quality; they are, therefore, very desirous of seeing ramie successfully cultivated in some country where the yield will be large and regular.

The soil and climate of the Southern States are particularly adapted for the cultivation of ramie, which requires a loose sandy soil and temperate climate. These advantages can be secured in any of the cotton-growing States.

At the present time most of our planters and farmers are financially crippled, and cannot afford to expend the large sums necessary to secure the labor to make cotton and sugar profitable crops, both of these articles require large capital and continuous cultivation to bring them to perfection, and both may be injured or destroyed by unfavorable seasons, or other causes. Cotton may be totally destroyed by the army worm, or other insects. The fibre of ramie, being contained in the inner bark of the stem, cannot be injured in that way, and will not be hurt by either long continued wet or dry weather; besides it requires small capital to start a ramie plantation, the plant being easily propagated and cultivated; it is a perennial, and will not require replanting.

Having been interested in ramie culture since its introduction in Lousiana in 1867, I have given my undivided attention to securing its successful introduction and cultivation, and bringing its worth and usefulness properly before the southern public. I have made frequent experiments in extracting the fibre from the stem and preparing it for use, and have tried plants grown in this and other States with the most satisfactory results. I find that our fibre is even finer than that of Java, and that the yield per acre is greater. In any of the cotton States ramie can be harvested at least three times a year, each harvest or cutting will produce between nine and twelve hundred pounds, making an average annual crop of about 3,000 pounds of crude unprepared fibre, worth at present in Europe ten cents specie per pound; in preparing the fibre for manufacturing purposes it loses about one-half, and increases in value to sixty-five cents per pound. Thus, it is apparent that ramie, requiring little or no tillage to produce such magnificent results, is the most profitable crop that the planter can cultivate.

The fibre, when prepared for the spinner, is beautifully white, soft

and glossy, closely resembling floss silk in appearance; it is much stronger than the best flax, and readily receives the most difficult dyes without injury to its strength or lustre.

MODE OF PROPAGATING.

A rich, sandy soil is the most suitable for ramie cultivation, and is particularly desirable for a nursery, where plants are to be rapidly propagated. For field culture the plant will thrive in any good sandy land. To secure a rapid and vigorous growth of roots, the land should be thoroughly and deeply broken up to a uniform depth of about ten inches, and well pulverized. This is highly important, and should be carefully performed to insure a rapid accumulation of roots.

In propagating, level cultivation is preferable; root cuttings should always be used for first planting.

After the ground has been thoroughly prepared as above directed, the roots should be planted about six feet apart each way, three inches deep, and slantingly, with about one inch exposed above the surface; care should be taken to keep the ground moist around the roots when first planted. No further attention, with the exception of weeding, is required until the sprouts are about two feet high, when they should be gradually and gently inclined towards the earth. When they have attained a height of three or four feet, it will be noticed that they become of a brownish color near the root; they are then ready for propagation. Incisions should then be made with a thin, sharp-pointed knife at each eye of the stem, which should then be bent gently down, and covered with about three or four inches of loose earth, care being taken to avoid detaching the stem from the parent root. About six inches of the leafy end should be left uncovered. In the course of three or four weeks these layers will have taken root, and may then be separated from the main root, divided in pieces, and replanted. In planting in the field, layers may be laid down without being divided.

FIELD CULTURE.

After the ground has been ploughed deep and thoroughly broken up, it should be laid off in beds, running the length of the field; these should be made about six inches high and four feet wide, with a flat surface; passages three feet wide should be left on each side, and cartways at intervals through the field. A shallow furrow might be run down the center of each bed. If roots are to be

planted, they should be put in the ground slantingly, three inches deep and two feet apart, with end projecting above the ground; if layers are to be planted, they should be laid in a furrow about three inches deep, horizontally, with the ends lapping, as in cane planting. After the first year's growth has been cut, new sprouts will issue from all parts of the bed; the growth will become very dense and choke out all other vegetation.

Harvesting.

When the stems have attained a height of six or eight feet, they are then ready to be harvested; but should it be inconvenient for the farmer to commence cutting at the time, the fibre will not be seriously injured if left in the field for a week or two longer. In cutting the stems an ordinary cane knife may be used, care being taken to cut the stem a little below the ground. It will also be advisable to extract the fibre when the stems are not too dry, as that labor is then much more easily performed, and the fibre is of better quality if broken out while in that condition. A simple and easily worked machine, similar to the ordinary flax breakers, is being constructed for that purpose. With this, the planter can make his crop marketable at small expense. In preparing the fibre for packing, it should be done up in hanks, and packed in bags or bales like cotton. All refuse matter, such as leaves, the woody substance of the stem, etc., should be strewn over the field. No other manure is required.

Corn Planting.

Mr. J. B. Lyman.—Corn growing is the peculiar mission of the American farmer. We accept this royal plant, the country over, as the type and unit of our agricultural estimates. Land, with us, is well described by saying how much corn it will grow without manure. The idea of sterility cannot be more perfectly conveyed to the mind of an American farmer than by saying that a country will not give ten bushels of shelled corn from an acre. Corn is peculiar as an American crop, because it so hits the variations of our climate. It is a tropical plant, and will not show its regal nature unless well nigh roasted by a blazing sun. Yet it is a great lover of moisture, and requires generous supplies of it. Hence it will not do its best without frequent rains alternating with torrid suns. Intense heat, with abundant moisture are generally the characteristics of a summer in the United States, east of the great plains and south of the great

lakes. We have, in a general survey, three climates in the United States as regards corn. North of a line drawn west through New York city, the hazard in growing maize is from the shortness of the season. Corn wants not only ninety days absolutely free of frost, but at least sixty days of intense heat; and in New England and the vicinity of the lakes, there is generally only a month of torrid weather. But by selecting varieties which grow fast but not high and ear heavily, large crops are produced in the cool States; but it is only done by high and constant manuring. It often happens that a bushel of corn in New England has cost half a cart load of the best stable manure, beside the usual labor of the plow and hoe.

The belt between forty degrees and thirty-six degrees, or the region bounded on the north by a line drawn west from New York, and south by a line drawn east and west through Nashville, and extending westward to the Missouri river, is the chosen home of this magnificent cereal. Here is no difficulty from early or late frosts. The large growing varieties can be cultivated, and the agriculture of this tier of great States rests on Indian corn as its corner stone. That the south is not as well adapted to growth of large crops is proved by the census. Lousiana, the richest southern State, giving but seventeen bushels as her average, and South Carolina but six bushels.

This week, from the 10th to the 17th of May, is the planting time for two-thirds of the whole crop of the United States. In the extreme south they are now at the first hoeing, and in the northernmost States some of the best crops are raised by waiting till near the first of June, when the ground is thoroughly warm. Corn sprouts most rapidly at the temperature of ninety-three degrees. At fifty-three degrees it hardly grows at all, and below that it rots. When the average heat is below seventy degrees—that is, when a fire is necessary to entire comfort in some part of the day, corn will wear a yellow hue, and show a tardy growth. In the Atlantic States, the finest corn crops are found on the level loams and gently rolling lands of middle Jersey and east Pennsylvania. Take a compass, plant one foot on the City of Brotherly Love, let the other swing round, sweeping as far east as Newark and as far west as Harrisburg, and you have encircled the best corn lands on this slope. To find better one must descend the Ohio Valley. For a few days past we have been moving about among some of those happy husbandmen who have either one of our two greatest cities for a market,

and 100 or more acres of fertile land beneath their feet. Some of them are able, as a regular practice, one year with another—not as a lucky hit, but as customary achievements in agriculture, to harvest seventy bushels of shelled corn from each and every acre planted. I have never known a farmer thus successful with our great American crop who did not practice certain rules in his tillage, who did not have a method and well considered plan in his operations.

The farmer, or class of farmers, who can generally report seventy shelled bushels per acre, are not lucky—they are sagacious. They know how to grow corn. The average reported by the Agricultural Department, about twenty-five bushels per acre for the whole country, proves that some of us don't know how to raise corn, or do not enjoy a soil and climate to make such knowledge pertinent. The practices of these seventy bushel corn growers, properly known and digested, furnish a table of instructions for less thrifty farmers. We numerate some of them:

First.—The farmer who regularly cribs large crops never thinks of putting his corn on a field lacking in vegetable mold. If he is operating on a virgin soil, crop may follow crop for a number of years, but usually he plans a rotation, with corn at the head, on sward land. Manure a mow lot in the fall, and turn the sod in April following. In clover, feed moderately in the fall and plow under in the spring, when the green foliage of the surface will hide the hoof of the slow stepping horse. The decaying turf does not sustain the corn by furnishing plant food merely. Its chief aid is by arresting moisture and carrying the corn roots through the parching days of midsummer.

Second.—Our seventy bushel corn grower does not lean wholly on a sod. He helps the rotting turf with manure; generally with good yard compost, well rotted and harrowed in, or with the dung of grain fed animals in the hill, or with guano.

Third.—His variety is twelve rowed or sixteen rowed dent corn, or Ohio dent, selected with care from stalks that hold two or more ears, and from ears over a foot long, well rounded off.

Fourth.—In marking off he is governed somewhat by the strength of the soil, but most frequently plants in hills four feet apart each way.

Fifth.—The crow, the wire worm and the grub he disgusts by soaking his seed in copperas water, or dilute sulphuric acid, and rolling in plaster. Guano and dissolved bones in the hill are well mixed with the loam. Wood ashes and plaster are often applied if the crop is late and low colored.

Sixth.—He never puts corn after corn in the best of soil without most liberal manuring, any more than he would drive a favorite horse sixty miles for two days in succession.

Seventh.—He cultivates with the plow or harrow, and with these alone, except a hand weeding if the hill is foul. The first plowing may be deep, but the successive stirrings are of the surface only. The drier the weather the more he relies upon the tooth of the cultivator to carry him through.

PLANTING PEARS.

Mr. John R. Waller, of Dubuque, Iowa, has planted a pear orchard on ground industriously prepared. He dug holes three or four feet in depth, filled in with small stones, covered these with loam and forge cinders, iron filings, &c. He asks the Club if this was the true way to do.

Mr. A. S. Fuller.—These rules about a special underdraining and very deep trenching for the pear and other fruit trees were imported from a different soil and climate. In England and some parts of France they have too much rain, and their orchards require special attention to secure drainage. But with us these precautions are not needed. When he plants another orchard, let him look mainly to the richness and fine divisions of his soil. He should plow, harrow and fertilize as though he were making a garden.

Mr. J. W. Gregory.—As to iron filings, it is a question of soil; most soils have some iron, many have too much; where there is a deficit of iron, as happens in granite countries and on many alluvial soils, it should be added, especially for fruit trees. Color is found to depend on the presence of iron, and fruits, on some soils where this admixture is just right, show the most admirable tinting; on others the coloring is dull. As a rule, if the water of a country does not show iron, it will be safe to apply it to fruit trees, and often iron is required by them.

GAPES IN CHICKENS.

Mr. S. M. Disbrow, of Old Bridge, N. J., has gapes in his chicken-yard, and applies to the Club for a remedy.

Mr. S. Edwards Todd.—Last summer I was at the house of a friend in Western New York, who has 150 young turkeys, many of which was suffering from this disease. I took a large horse-hair, made a loop with it, and carried it down the throats of the young turkeys.

By a little skill and practice one learns to draw out the little worms which fasten on the lining of the windpipe and cause this malady.

Dr. William W. Sanger.—A short time ago I was at the house of a friend who complained that his poultry were suffering from gapes. Like most physicians, I am seldom without a little roll of nitrate of silver, lunar caustic, in my vest pocket. I caught a young turkey, and made a single application to the inside of its throat. It was effectual. Others were similarly treated and recovered. I reasoned from analogy. It is an inflammation, and all know that lunar caustic has the power of changing the form and character of morbid conditions in the human throat. It is the common remedy in diphtheria, putrid sore throat and some other affections. It is easily remembered and quickly applied. If any poultry-raiser near the city has the gapes in his yard, I will come and apply this remedy for the sake of knowing whether in a large number of cases it is a true cure.

Mr. J. B. Lyman.—Some will lack the skill and patience to handle the horse-hair as Mr. Todd describes; others will be afraid of Dr. Sanger's remedy. The Germans call lunar caustic the hell-fire stone, and the name is not a bad one. Thousands of cases are cured every year by a much simpler remedy. A few years ago I had a brood of eight chicks that I thought a good deal of; they came on finely, but about the middle of July the gapes appeared among them. Three or four coughed violently at night, and seemed to be much distressed. I mixed pepper and sweet oil, making it strong with the pepper, and swabbed out their throats with a small, slender feather about five inches long, the plume stripped off from one side. Most of them were cured by one application; one or two needed a second dose of the pepper and oil. If sweet oil is not at hand, melted butter may be used.

Mr. J. C. Thompson.—I prevent the gapes rather than cure it. This I do by keeping my young poultry on fresh ground. As soon as a hen comes off she and her family are removed from the poultry-yard, and the chicks range on soft, fresh earth. In this way I avoid disease. There is something, also, in their food. They do better on cooked food, a pudding made by boiling coarse Indian meal; but wheat screenings are better than any form of corn meal.

Appointment of Chemist.

The Chairman.—I take pleasure in announcing that the Trustees of the American Institute, acting on the recommendation of this

Club, have, without dissent, appointed Mr. James. A. Whitney, associate editor of the Artisan, Professor of Applied or Agricultural Chemistry.

Professor James A. Whitney.—I have reason to thank the Club, and to tender my acknowledgements to the officers of the Institute, for this honor. There are those who are unwilling to admit that chemical science has done anything worth mentioning for the farmer. I think it can be proved that the crucible and the retort are, when properly understood and wisely applied, the best friends of agriculture. Instances are numerous in Europe, and not wanting in this country, where the most progressive, the most thrifty and sagacious farmers, have been excellent chemists, and often called in analysis to aid experience. At some future time, at our next session, in fact, if the Club please, I will present a paper in which I shall endeavor to show how and where the laboratory will assist and advance the agriculture of the future.

The Chairman.—Such an essay from our chemist will be peculiarly suitable and welcome to the Club. We will regard it as the special subject at next session. I will here say that Mr. R. H. Williams proposes to read his views on the best manner of conveying agricultural knowledge, and inspiring rural tastes in the young men of the country.

Cheap Cover for Haystacks.

Mr. Charles P. Thatcher, Decatur, Macon Co., Illinois.—I should like to inquire of the Club if they can recommend to a hay raiser any article that would answer for the purpose of covering a stack, when partially completed, to protect from rain; also as a permanent cover when the stack is built. A large percentage of our hay spoils in the stack from the rain during the winter, and we are sadly in need of some sort of a canvas covering that will be water-proof, easily handled, and always ready; not too expensive, and yet strong enough to resist pretty trying wind. An answer through the Club reports will be very acceptable.

Mr. J. B. Lyman.—Buy for each stack ten or twelve yards of heavy, tight-woven, unbleached cotton cloth; make it up square, like a sail, with a hole in the middle for a pole, and bind a stout cord around the edge. Boiled linseed oil, thickened with any powder or stuff that will make a paint, will answer as a coating. Apply two coats quite thick. If the weather is cool it will be better. Try the

paint first on a small piece of cloth. Drive stakes and have cords at the corners to lash it down with. Regular tent canvas is better, but costs more.

Farm Boys.

Mr. W. L. Curtis, Clyde, Ohio.—Fifty years ago my eyes first greeted the light among the eternal and grand old hills of Vermont, and at the early age of seven I was set at farm work, such as picking up potatoes, apples and small stones, and as I grew larger, was allowed to pick up larger stones, also brush and chunks on the fallow, and as I grew on I learned to drive team and hold plow on stony side hills, where my shins were well barked, and my abdomen well punched with plow handles left nearly sharp enough for fence rails, instead of being squared off and rounded as they should have been by the maker. I also learned to swing the scythe where cobble stones made plenty of work for the grindstone. Well, in those days, what else should the boys do but farm? Burlington, our county seat, fifteen miles away, would not be visited more than two or three times during minority, and then not to tarry over night. There were but few stores, and few mechanics; hence the draft for clerks and apprentices was light, and also for teachers; and as everybody must work, what should they do but farm? When I arrived at fourteen years, my father, as every sensible man should do, who has a number of boys and no land, took his departure to the west, and brought up in Huron county, Ohio. Here was woods on woods, some whole townships with not a dozen families; but a poor man's labor would bring a good living, with plenty of chills and fever; yet us boys had no hills to climb, no stones to pick up, and no Canada thistles to bind, and land cheap, if wages were low. Had I a hundred boys, and never so many stones, I never would set one of them to picking them up, unless I made a bee, or in some way diverted their minds from that (to them) most discouraging of all work. At that time there seemed here, no less than in Vermont, no opening for boys but the farm. But the Erie canal and steamers on Lake Erie were pouring in the immigrants, before whom the big woods soon melted away, and villages and cities began to multiply, canals, telegraphs and railroads became the order of the day, each with its great vacuum to be supplied from the most promising of our farmer boys. The demand for teachers had also greatly increased, and where the boys had been working for ten to fifteen dollars per month, they could now get twice that, and at lighter work. Boys

with common school educations were not long in finding out that in one quarter at the seminary they could qualify themselves so as to get from twenty dollars to thirty dollars per month at teaching, which required but six hours a day instead of ten to twelve, and could have soft hands and clean shirt collars against horny hands, dirty shirts and muddy boots. Then, amid all this came the cry of gold from over the Rocky Mountains, for which Young America made a stampede, and finally the war, together with a not inconsiderable drain to the large cities for clerks and bookkeepers. Another and not trifling cause of our boys shunning the farm is, as farmers become wealthy they are more lax in educating their sons in manual labor. The habits and diet of the household have so changed that the present is not in physical power and endurance what the former generations were. Our sons are many of them weakly and delicate, and inadequate to the sturdy requirements of the farm. I know it is said that the substitution of horse-power has greatly lessened the demand for man-power; but that man who works his mower or thrasher up to its capacity has not as yet found the easy place. We heartily indorse the principle of making our farm work as easy and attractive to our sons and hired men as possible; but in doing all we can to change it into pastime, we cannot expect it a reason sufficient to keep our boys on the farm, when they have come to majority. When leaving the parental roof, none of us would advise our boys to work for twenty dollars, when for the same time they could get forty dollars at work just as honorable. To retain those boys at farming who have the vim and ambition to do something creditable for themselves, we must go with the market and bid against railroads, commerce, manufactures and navigation; and when we can give a salary of $1,000 to $1,500 there will be plenty of boys to stay at home, and such as will be creditable farmers, too. The main obstacle at present to successful farming is the high price demanded for labor, and the crude and inexperienced material we have to supply ourselves from. We rejoice at the awakening interest in agricultural colleges, but they can do little for us in our present need. We must teach agriculture ourselves, and could there be some plan devised by which to select from our incoming immigrants, those suitable to our needs, with an assurance on our part that they should be well dealt with, and that each additional year's service by the same person should be rewarded by presents or higher wages, or both, we could afford to them entirely different advantages than to those, who, do as we may, we cannot

expect to keep but a few weeks or months at most. In other days the young man without endowment had to practice the strictest economy in personal expenses and save his earnings for long years before he could think of buying his fifty or 100 acres of even wild land. But now the 160 acres awaits him without money or price, and the boy who does not avail himself of it, offers small promise if he remains at home. Thus we see on every hand demand for the trusty, educated and active boys far beyond the supply, and if our sons can do better to go than stay at home we should be glad rather than sorry. The equilibrium will come by and by, meantime we must do as we used to do when we lacked sufficient teams—break more steers.

Clock Power for Churning, &c.

Mr. M. V. B. Rowley, Worcester, N. Y., had on exhibition a small model and also a large working specimen of a device for storing power to be applied to domestic labors, such as churning, pumping, fanning grain. A large weight of 200 pounds or more, is suspended like the weight of a town clock, and by its weight turns wheels to which a pendulum is attached. The ball of the pendulum slides up and down, thus regulating the rate of motion.

Dr. J. V. C. Smith.—I hope the merits of this ingenious contrivance will be well examined. All need contrivances for diminishing domestic labor, and especially such as are performed by the treadle. Physicians are well aware that sewing machines impair the health of thousands yearly by the cramped position, and the demand they make for an unnatural action of the muscles of the lower extremities. If this can be made cheap enough, it may furnish power for driving sewing machines in families.

Mr. S. E. Todd.—Whatever advantages it may have, it does not produce power. The power exerted in pumping or churning is no less than the effort required to wind up the weight. Its advantage is, that by vigorous exertion, for a few moments, by a man or a horse, power is stored up which will last several hours.

Mr. J. B. Lyman.—This contrivance, no doubt, has merit in a degree. How far we ought to recommend it to farmers for churning, &c., we cannot judge from the models now at work before us. We should see it at work, as it generally must be at farm houses, under some disadvantages, and without the presence of a skilled mechanician. I suggest the appointment of a committee to look carefully into its merits and to report on the uses to which it may be applied on farms.

Chairman.—Such committee will consist of Messrs. Lyman, Todd and J. C. Thompson. They will go to the premises of Mr. Thompson on Staten Island and report upon the action and value of the machine in operation.

BUGS IN PEAS.

Mr. William J. Miller, Woodhull, N. Y.—I find a good many of my peas affected like the ones inclosed, and would like to know if there is anything that could be applied that would destroy the bugs without destroying vegetation in the peas.

Chairman.—We have with us a gentleman who has made the insects injurious to vegetation, the study of his lifetime. He, I am sure, can satisfy our friend from Woodhull. Please give these peas to Dr. Isaac P. Trimble, of Newark.

Dr. Trimble.—This bug or weevil in the pea is well nigh universal; at least over wide sections of the country. In the northern part of New York and New England, he does not usually affect the peas so seriously. Hence, seed peas ought to be raised north of Albany and Boston. A very small egg, that soon becomes a minute worm, is laid on the back of the pea-pod. The little animal eats his way into the middle of the pea, and slowly matures into the weevil that we find in these peas. When the pea is green, he is so small as to be below notice. But when the ripe pea is brought to market, the size of the worm, and afterward of the bug, is such as to make most dried peas unfit for the table. Fowls prefer them, and they will generally do as well for seed as sound peas. They do not affect the earliest of our peas, nor the very late varieties; but the Marrowfats and English mammoth are always infested with them. As nineteen-twentieths of our pea crop is eaten green, the difficulty is one of little practical importance.

MULBERRY TREES FOR ROBINS.

Mrs. Eliza Mann, Wheatland, Monroe county, N. Y.—About the first of June, when the small fruits begin to ripen, the agricultural papers will be filled with complaints of the birds' depredations and inquiries as to the means of preventing them. Now, the only way to keep that saucy fellow, the robin, from eating berries and cherries is to give him something he likes better. I would suggest that cultivators of small fruits should plant the white Italian mulberry, as freely as possible, around and among their trees and vines. The mulberry has proved, in my experience, a perfect protection

from the birds. When we first began to raise raspberries and strawberries there were several large mulberry trees in the garden. They bore great crops of berries, and were full of birds, feasting upon them, as long as they lasted. But neither robins nor year-birds ever seemed to notice the other kinds of berries. Unfortunately, the mulberries were cut down, and since then they have taken, every year, full half the strawberries and a great many raspberries. We have young trees growing, and hope to see the birds, before very long, enjoying their fruit and letting the others alone. The tree grows freely from suckers, cuttings, and bits of root. The fruit begins to ripen about as early as any of the small fruits, and keeps on ripening a succession of berries for several weeks.

Lime with Yard Manure.

Mr. Wm. F. Smith, Ligonier, Pa.—I have been an interested reader in the discussions of the Club on various subjects of importance to the farmer; I would like the opinion of the Club on the best manner of applying lime and barn yard manure on corn ground. Would it be good policy to apply both at the same time, or would it be better to plow down the manure and spread the lime on the top?

Mr. J. B. Lyman.—Keep your lime away from stable manure always. Why? For this reason, Mr. Smith. The best part of yard manure is that which gives the pungent smell about a horse stable. Drive away the whole of that and your manure is as good as so much swamp muck and not much better. Of all things that you could use quick lime will drive out that ammonia the quickest. The best time to put on lime is late in the fall. Apply it then by itself. If you want to compost your yard store mix peat, muck, rotten leaves, old sawdust, and tan bark, and more than all, decomposed turf; but keep your lime and your ashes away from animal fertilizers.

Adjourned.

May 18, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Protecting Plants from Insects.

A substance claiming to be useful as a fertilizer, and at the same time a protection from striped bugs, thrips and other little animals

that eat leaves was exhibited, and a bottle of it given to Dr. Isaac P. Trimble for trial.

Mr. J. Dixon, Canandaigua, N. Y.—The soot from anthracite or bituminous coal, when sprinkled on vine plants, will protect them from yellow bugs, worms, flies and insects, and vermin of any kind. The soot from wood ashes will answer a good purpose, but it is not as efficacious. It should be sprinkled on the plant and hill while the dew is on, and before the fruit is formed. It will also protect currant and gooseberry bushes, as well as fruit trees in general. It may be well to renew it after a shower. All insects and vermin avoid aromatic and pungent articles.

The Secretary.—I keep my garden free of these pests every season by syringing the plants frequently with a decoction of quassia bark. The druggists let me have it at ten cents a pound. I use two or three pounds a year, making several gallons of the tea at a time. It is intensely bitter, and the bugs do not seem to relish the taste of it any better than a doctor's patients do.

Mr. J. C. Thompson.—On cucumber and squash vines I can keep away the bugs with fine bone flour. It is the best fertilizer, and I sprinkle it when the leaves are wet with dew or rain. Almost any fine powder will answer. Plaster of Paris I have found effectual, and even fine road dust. Probably the sure way would be to bedew with the tea mentioned by Mr. Chambers and then sprinkle with the powder.

A member.—Throw half a peck of hen droppings into a pail of water, and let it soak. The liquid manure thus produced will at once fertilize the hill and drive away bugs.

Canning Corn.

Mr. Zenia A. Lindley, Montrose, Pa.—In answer to the inquiry of Lizzie Treat, about preserving corn, I would say that I have no trouble. I boil the ears fifteen minutes, then cool and partly dry in the sun. Remove from the cob, and salt as for table use. Put in cans, adding a little water; boil the cans in water, as in canning fruit, about thirty or forty minutes, and seal with solder while boiling. To be kept in a cool place.

Northern Limit of Sweet Potato.

A gentleman living among the mountains in one of the northern counties of Pennsylvania, asks whether he is precluded by climate from raising the sweet potato.

Mr. Henry T. Williams.—I think he is; he cannot be encouraged.

Dr. Isaac P. Trimble.—Mr. Williams is quite right.

Mr. T. C. Peters.—How doctors will differ. I have known the sweet potato to be grown as far north as Lake Ontario, in a sandy soil.

Dr. Isaac P. Trimble.—As a curiosity, merely, or to see what one can do. The sweet potato ceases to be a profitable crop when one goes north of New York city. Not many are raised north of forty degrees. It requires a long summer and a mellow autumn.

Mr. J. C. Thompson.—Some time ago, traveling in Pennsylvania, I met a German farmer who told me more about the sweet potato than any person I ever saw. He said he could grow the tubers of any shape he wished, and give a person long or short, slender, chunky or flat, to order. He showed me his modes, and on coming home I made some trials. First, as he directed, I stamped the bottom of a furrow and made it quite hard. Then laid down the sprout of sweet potato and covered it with long manure, with a little earth atop. Then I laid sods in the bottom of the furrow, then a board, covering with manure and a little earth. The result was the same in each case, the potatoes ran along the board or the hard bottom, and were in some cases two feet long. The best management, however, is that which gives a potato nearly round. It sells the best by thirty or forty per cent. In Kentucky the farmers cut the seed potatoes into small pieces, and when they are sprouted, set them out. In cultivation there is some dispute whether the ridge or the hill system is best. But those cultivated in hills are the best, and they are less liable to be eaten by mice. With us the sprout only is planted. The soil should be dry and warm, and the exposure southern. The sets may be put out any time from the middle of May till the middle of June.

The Walla-Walla Valley.

Mr. H. Parker, of Washington Territory, read a paper on the attractions of his home in the far west. The Walla-Walla Valley is in the south-eastern corner of Washington territory, about 200 miles from Boise City, in Idaho, and about 400 from the point on Salt Lake where the last spike of the Pacific railroad was driven. The settler can get there either by way of the Pacific railroad, at a cost of about $200, or by the way of San Francisco and Portland, on the Columbia river, at a cost of about $300. He advises the overland route. The advantage of this valley over nearly all the Rocky mountain country

consists in the mild and delightful climate. The Blue Hills, and beyond them the Rocky mountains, protect this valley from the sweeping winds of the Great Plains; and the Cascade Range, between it and the Pacific, breaks the rain clouds, and gives a climate sufficiently dry. The winters are mild, though the latitude is as high as that of Nova Scotia. The coldest is from the middle of December to the last of January. The snow seldom remains on the ground more than eight or ten days at a time. This is all that the people of the Atlantic States would call real winter. The valley is well watered by mountain streams. If people arrive healthy, they have not much to fear from disease—only death from old age. I have never known a person to contract any pulmonary disease in that climate. Their outlet is by stream on the Columbia river. The Union Pacific railroad is making preliminary surveys for a branch road which is to run through the valley. Apples, peaches, pears, plums grapes, and all the common fruits do well. The mines of Oregon, Montana and Idaho consume surplus products. Improved choice lands can be purchased in quantities from forty to 160 acres, from five dollars to thirty dollars per acre. There are thousands of acres yet open to *actual* settlers under the homestead and pre-emption laws. An abundance of timber is of easy access in the mountains, and some on the stream through the valley. There are four churches in the city of Walla-Walla, besides many other places of religious worship throughout the valley. There are two district schools, beside an academy and seminary, and there are more than a dozen public schools in the valley. The population is between seven and eight thousand. The grazing and stock-raising facilities in the valley cannot be surpassed. The streams from the Blue mountains are of pure cool water, which can be led to all parts of the great plain below by canals of not costly construction, which would enable the farmer to regulate the amount of moisture in his fields. Parties wishing further particulars relating to this and other sections east of the Cascade mountains, can obtain same by addressing Mr. Parker, Walla-Walla City, Washington territory.

AGRICULTURAL EDUCATION — WHAT IS IT? HOW ATTAINED AND EXTENDED TO THE PEOPLE.

Mr. R. H. Williams.—Were I called upon to answer this question in the briefest, yet most comprehensive language, I would say that agricultural education proper, may be attained and extended to the

masses only by practical demonstration, through the medium of experimental farms, conducted by the best practical and scientific intelligence combined; the whole aided and sustained by governmental endowment, that the means may be ample for experimental investigation and demonstration, without regard to immediate returns in dollars and cents. It should also be continuous, from generation to generation, that the accumulations of knowledge resulting from the experience of each may be carefully recorded with processes and results. These should also be given annually, or oftener, by intelligent reports, to the public in such manner as to reach all interested, and enable them to adopt the useful and practical, and avoid the theoretical or undeveloped visions of empirics. Hence the appropriateness of those munificent land grants to the States by Congress.

Briefly, this is my interpretation of the much agitated and long mooted question of agricultural education; and I am aware that it is materially different from the commonly received and widely promulgated idea in relation to this all important subject.

If I am right, then is all else heretofore and at present in prosecution in this whole land—yea, nearly all Europe too—nothing else than *scholastic* education; and, like all rudimental instruction of the kind, by whatever name known, exclusively devoted to the training of *youth* through their literary and elementary scholastic period. Why call such any more agricultural education, than it is mercantile, legal or mechanical. Do youths graduate from such institutions merchants, lawyers, artizans. mechanics, or anything else but as scholastically and elementarily educated boys, except for farmers? No, no such idea has ever been entertained for a moment. A legal education requires the practical training of the law office and courts; mercantile education that of the sales and counting room; the mechanic that of the shop, and the artisan the studio; the sailor the deck of the ship; and the *useful* engineer, civil or military, the field of *practical* application.

Why, then, is it even a supposable case, that a boy may be taken from the farm and *scholastically* educated into a practical, scientific farmer, fitted to lead and instruct his fathers at the period and under similar educational influences, where all other classes are only regarded as prepared to enter upon the *practical attainment* of their specific department of knowledge? and, especially, a department where the novice in practical knowledge is universally more conspicuous and less successful than any other—as is patent to the most

common observer, with those engaging in agricultural pursuits without experience or practice.

That there is no good reason for such conclusion, I am not only forced by my own observation and experience, but all authority upon the subject tends to discard the idea that anything short of practical application is efficient in qualifying the individual for an intelligent and successful prosecution of the business. Yet strange as it may seem, agriculture is the only pursuit where it is proposed, both by governmental influences and individual practice, to graduate the *school boy* at once to the leadership and instructor of the lifelong experienced and practiced devotee to the business.

That this anomaly in the practice and ideas upon this subject of agricultural education must have some foundation or reason underlying it, I cannot for a moment doubt, and that that reason is the fact that all true knowledge in the art lies in the path of *experimental* investigation led by practical and scientific experience and personal application aided by governmental encouragement and patronage in the direction and through the medium of *experimental farms*, instead of so-called *agricultural colleges*, which at best are only adapted to the scholastic education of youth.

This, in our country at least, is that which agriculture has never received, but what it must have before it can rank as, an established and systematized pursuit, having that exact knowledge so common to other vocations, and this omission has doubtless grown out of a misapprehension of the necessities and a mistaken view of the means to supply the needs and wants of a pursuit, which, though lauded by all, is nevertheless regarded as the province of second rate intelligences, requiring sufficient physical and mental powers to perform the service of drawers of water and hewers of wood to a class whose professional aspirations too often assume to direct and guide in provinces even where they are really and only novices? Hence the provisions of the act of Congress donating land to the several States for the "benefit of agriculture and the mechanic arts" contains the restriction that the *income* shall *forever* and *only* be applied to the endowment, support and maintainance of at least one college in each State where the leading object shall be "such branches of learning as relate to agriculture and the mechanic arts," the State to furnish the buildings, &c., within a time specified (five years) for "one or more" colleges, or forfeit the appropriation.

Here let it be observed, there is not a practical or useful idea to be

attained through such specified institutions that is not already within the province of all, and in practice even now with many of our collegiate and academic institutions in several of the States, and, in tact, the effect of the restriction in the act alluded to, has resulted in simply inducing the legislatures of most of the States, to assign the control and avails of the vast tracts of land to any simple institution of scholastic capabilities within the State, already organized, or to be organized with a sign board of "agricultural department" added to their former list, without any necessary material change of programme, where previously the general and specific sciences were scholastically taught and demonstrated.

That agricultural *practical labor* can be efficiently introduced and carried out in our mixed scholastic institutions for this branch only with profit and success, requires but a moment's reflection to see the total fallacy of the attempt, and those specific institutions, when partial labor is required to mitigate the expenses for the scholastic period, as in the case of the Agricultural College attempted to be established at Ovid, Seneca Co., N. Y., and the People's College at Havana, N. Y., where both now stand glaring monuments of impractibility and total failure, not from the want of either State or individual endowment and pecuniary encouragement, but the total absence of adaptability to meet the agricultural educational wants of our country, and the evident folly that it would be on the part of parents to devote their sons to four years separation from home influences and duties to attain two years scholastic advantage.

This is the European, pauper feature that has been prominent with such institutions established by land owners for the education of overseers of estates, from the indigent working classes, requiring of those thus scholastically educated to work out a portion of the expenses, consequently doubling the time required to reach the same proficiency, and without the ability for experimental demonstration within expenses, and it is to the American youth and farmer the objectional, and hence impractical, feature of all of the proposed systems of so-called agricultural institutions heretofore presented.

I therefore repeat that agricultural education, beyond that of the American farmer's home practical influences, must be through public institutions conducted and managed by the skilled labor of those who have passed the *scholastic* period proper, and entered upon that of the *practical* and *demonstrative*, and which I insist can and may

only be thus made eminently beneficial to the whole community, through experimental farms.

That experiment and demonstration must confirm *theory* and establish its claim to be called *science*, and command the respect of the masses as practical. I would cite the concurrent testimony of nearly all writers and legislators upon the subject, yet even some of these self-same individuals have been regarded as the authority for agricultural colleges. Certainly they have never presented anything better in a tangible form, notwithstanding the evidence is that the investigating mind has long been drifting towards *experimental development* as the true source of agricultural progress.

Mr. Coleman, who traveled extensively in Europe, and published his observations and gleanings in two of the most instructive and interesting volumes extant upon the subject, and who has been more quoted as authority for our agricultural colleges than any other, says: "Mere theory I distrust; self-conceit, which is often harmless, amuses me; unfounded pretensions I hold at their true value, and low, interested quackery I despise," and asks, "*what is science?* He answers: "Not merely the knowledge of books; not merely a familiarity with the technical rules of any art; not mere hypothesis and conjecture, however subtle and profound, but the *observation* and the *accumulation of facts;* the following them out in their relations and bearings and the tracing, as far as human sagacity can go, all the circumstances and influences of which they appear to follow, as the necessary consequence and results." "This," he adds, "is the work of *mind* wherever mind is found."

Again, he says, "What I want to see is the *universal* mind awake. All the practical operations of husbandry furnish ample material for inquiry and reflection; and inquisitive and reflective minds constantly engaged in them, have some peculiar advantages in the study of them, over *philosophers* exclusively confined to their *closets* and *laboratories.*"

What a commentary is this in favor of the practical and experimental, added to the mere scholastic, and from one who had investigated the subject in all of its bearings and phases, both in America and Europe.

Again, I quote, in the preface to Law's translation of "Boussingault's Chemistry Applied to Agriculture," the author says: "I have thus been led, in addition to my own observations, to give those of numerous writers on almost every branch of agricultural science,

being careful to confine myself in each instance to the most authentic *practical* conclusions, for it is certain that *practical* data have the most direct interest for rural economy."

Says Liebig, in his work on Agricultural Chemistry: "It is not every one who is called by his situation in life to assist in extending the bounds of science; but *all mankind* have a claim to the blessings and benefits which accrue from its earnest cultivation." Again, he says: "Perfect agriculture is the true foundation of all trade and industry." And he adds: "I have endeavored to follow the path marked out by Sir Humphrey Davy, who based his conclusions *only* on that which was capable of inquiry and *proof*."

In a late address by Dr. Geo. B. Loring, President of the New England Agricultural Society, he says: "I am satisfied that the (our) present loose system of agriculture will be abolished before the youngest man in this room dies. I am satisfied that the business of farming will be systematized so that every man will feel he has something behind him besides *accident* to guide him in the business of carrying on his farm."

In Copeland's late work on agriculture, &c., the author says: "I maintain that in agriculture, *experience* must govern *theories*."

Even the members of Congress, when enacting the law in relation to lands "for the benefit of agriculture, &c.," before referred to, caught an inkling that something in the way of the *practical*, might, by possibility be reached, and therefore provided that the avails of the lands might be applied "to the purchase of *experimental farms*, whenever authorized by the Legislature of the State," but this is the only allusion or provision in the act to the subject, while so much as relates to agricultural colleges, specifies and *restricts* the State, leaving the inference irresistable that what was really of practical benefit to agriculture, was in their minds, an *undefined* idea, and the legislators of the States that have acted upon the subject, seem as ready shift the whole duty and responsibility upon individuals who are so magnanimous as to offer to take the sole charge of the interests of the agricultural community into their keeping by having the dispensing of the avails of a million acres of land (or less) committed to their hands.

Is it not strange that a people so jealous as ours of New York, of their public schools, should be so dead to the true interests of agricultural advance and improvement? It is now authoritatively stated that the land appropriation of this State to the Cornell University is

estimated to ultimately realize a sum equal to at least from three to four or more millions of dollars, and all this for devoting one wing of the institution to be called an "agricultural department," and in an institution located forty miles from any main thoroughfare of travel, and therefore inconvenient for *visits of observation*, a most important feature of an institution of *practical* development.

At Washington the government has established a horticultural, *experimental* garden, and devotes it to the demonstration of what may be received as practical and what should be rejected as otherwise; thus endorsing my experimental theory as applied to agriculture on a broader scale.

In addition to this horticultural *experiment*, Congress has established an "agricultural department," and devoted the appropriation necessary to conduct it, to the collection of statistics and agricultural knowledge and development, and for diffusing the information thus obtained through *monthly* reports; thus, again, endorsing an important feature of my plan for experimental farms.

Yet I regard this statistical information as coming within the range of *commercial* relations and interests quite as much as that of agriculture; and although desirable and even commendable, it only touches the outskirts of the *great want* of agriculture.

It is to this demonstrative, experimental system, thoroughly carried out and the results widely diffused among the community, that I look for that impetus to agriculture which nothing heretofore proposed has ever accomplished; and, if I am right, may we not hope to see agricultural knowledge as well defined and systematized as other practical business pursuits? But without some more efficient aid to determine *facts* and acquire *exact* knowledge, agriculture must remain as now, an *undefined* and *uncertain* pursuit, lacking both in *attractions* and *successes*, as compared with others open to and abstracting our young men from rural labor and country life. Is not this, then, the cause, or one of the *prime* reasons, why our cities and towns, the trade shops, professions and manufactories are crowded, while the rural districts and the farm are deserted?

A brief glance at the actual state of existing knowledge in relation to the most common occurrences and subjects of discussion that arise weekly in this Club, will suffice, I think, to show the *want* if not the *necessity* of greater certainty and more exact knowledge in agriculture.

About a year ago Mr. Greeley introduced the subject of *deep plow-*

ing, and advocated the feasibility and the necessity of deep culture of the soil even to "eighteen inches," or more, as a source of recuperation and improvement.

Mr. P. T. Quinn and Mr. A. S. Fuller and others, sustained this side of the question; but Mr. Quinn showed that ten inches is deep culture, and expensive at that. He insisted, however, that heavy manuring, even to 100 loads to the acre, was necessary to invigorate such deep turned earth.

Doctor Isaac P. Trimble and others, on the contrary, cite the experience of great numbers of the successful farmers in New Jersey, to show that from four to five inches *tilth* is all that is required, and far better than ten or more inches; and that even six inches is too deep culture for profit. The doctor brings an array of facts and figures to sustain his side of the question, which really become formidable arguments.

Mr. Peters inquires "What, in the opinion of the Club, constitutes deep culture," and offers a resolution to test their judgment upon the subject, declaring that all over seven inches should be regarded deep culture, and under five, shallow. The Club had no opinion to stake on the question, and therefore laid the resolution on the table by a decided vote, thus ending a discussion that had lasted more than six months, without arriving at a definite conclusion upon any question involved, unless by *inference*. It was that the deeper the culture the greater the necessity for manure, and the larger the quantity required, which, connected with the fact that all ordinary farming is dependent upon the means of accumulating manure from the products at home and the farm, and therefore limited, and thus forbidding Mr. Quinn's suggestions, except near large cities. This goes far to sustain shallow culture, although contrary to general and well received theory.

Who can state *definitely*, from absolute and well directed experiment, and *positive* knowledge, the best and most economical means for producing, preparing and applying the manurial products of a farm, the value, and best method, and time for applying wood and coal ashes, lime, salt, plaster, charcoal, &c.? How far may underdraining and irrigation be carried to profit on different soils? Are the common plow and harrow beyond question the best instruments for working and preparing the soil for crops? Who can answer and show, by *established* facts, that they *know?*

At a late annual exhibition of the State Agricultural Society,

held at Utica for 1865, in one of the evening discussions, the subject was "What is the proper condition for cutting and the best method for curing hay?" A subject supposed to be simple and familar to all; yet it elicited more than usual interest calling out the views and opinions of some dozen of the leading experts present, and on which scarcely any two agreed. Upon any question of agriculture however simple, is not such difference of opinion found to be the rule?

In conclusion allow me to direct attention to the fact that the United States, from 1839 to 1851, about eleven years, expended for the benefit of agriculture, but $29,500 and that, in the collection and publishing of agricultural statistics; and since that time has established the "Department of agriculture" with the agricultural garden before alluded to, located at Washington, D. C., and has donated land for agricultural colleges to the States as before mentioned.

The State of New York, expends annually from eight to ten thousand dollars in aid of State and county fairs; and be it remembered, that there is not one institution either in this or any other State of the union, devoted and applicable to the *demonstration* of *practical experimental* agriculture. Yet this is the department of human labor that yearly produces more actual wealth, both to the *State* and *nation*, than all other industrial pursuits together. In short the value of agricultural products, every two years, equals in amount the whole national war debt and interest, and is really the only actual source of production of *national* wealth.

Commerce is a mere transferring agent. Manufacturing the more important one perhaps of transforming the raw material into articles of utility; and mining, that of bringing to light the already produced material; yet these interests receive continually the fostering and protecting care of the government at the cost of millions on millions.

Must this always be so?

A glance at what is done, and being done in Europe may not be without interest in this connection by way of contrast.

Russia has in all sixty-eight agricultural schools and colleges, one of these institutions occupies 3,000 acres of land, and has forty buildings connected with it, accommodating several thousand students, and adapted to practical illustration. Besides, there is an agricultural society at St. Petersburg, established by Empress Catharine, which is a large and vigorous organization.

In France there are about seventy farm schools, besides several

colleges for the education of professors of the highest grade in all the sciences pertaining to the treatment of diseases in animals and improvement of stock, &c. She spends on three veterinary institutions annually the sum of 754,200 francs. On other institutions, for instruction in agriculture, 2,731,468 francs, and for the encouragement af agriculture in various other ways nearly 2,000,000 francs, (over a million of dollars).

In Belgium there are 100 establishments of various kinds for the encouragement of agriculturral education ; and the prractical *science* of agriculture is the most fashionable in the kingdom.

In Saxony there are five agricultural institutions; in Bavaria thirty-five; in Wurtemburg seven; in Austria thirty-three; in Prussia thirty-two; in Italy two; in Scotland two; Ireland sixty-three; and several in England.

Many of the above are devoted to thorough, experimental practical knowledge, adapted doubtless to the institutions and governments peculiar to those countries.

In connection with the establishment of an experimental farm must necessarily be found all the chemical and philosophical apparatus requisite for developing facts. Thus rendering it the best *practical* school for the student. And the management may be aided most appropriately and profitably, by a limited corps of educatable laborers as students, and at the same time diffuse annually and continually, that exact knowledge now so deficient among the operative agricultural population.

It is in this particular feature that the system herewith presented differs from all or any other yet tried in this country, and which I regard as furnishing all that agriculture, as a distinct pursuit, claims or requires from public aid, beyond that of a common benefit with others, from the Literature and School Fund of the State.

I ask for this subject the deliberate and candid consideration of every one directly interested, at least, interested in agriculture, and particularly the officers of agricultural societies and all institutions designed for the advancement of this great fundamental interest. If Mr. Cornell is right, and can supply this great, crying want, extend to him that cordial support to which he is entitled for his generosity. But if not, then let us at once seek the ways and means of supplying this great need to the mother of arts by other and efficient means. For we cannot and must not, as we love our interests and regard our moral obligations in the eyes of the world, allow it to languish.

Mr. J. V. C. Smith moved a vote of thanks to Mr. Williams, for his able and erudite paper. This was seconded and carried.

REPORT ON WEIGHT POWER.

The committee, consisting of Messrs. Todd, Lyman and Thompson, appointed at the last meeting of the Club, to report on a weight power exhibited by Mr. V. B. Rowley, of Worcester, New York, after describing the action and principle of the contrivance, come to a conclusion as follows: Your committee may be allowed to say that the principle employed in that power seems to be mechanically correct. Its future success will depend on the proper construction of the various parts. And, lest some beginner should be misguided by our suggestions, it may be proper for us to give a few suggestions of well-known principles in natural philosophy. Every person should keep in mind the law of force and motion, that after a man has wound up a heavy weight, that weight will not render him any more available power for churning, or for anything else, than he expended in winding it up. If, for example, he has five gallons or more of milk, or cream to churn, it would require an exertion equal to lifting from 2,000 to 4,000 pounds to work the churn twenty minutes or half an hour. Therefore, after a man or boy has wound this weight up a few times, to do the churning, it is probable that he will feel very much disposed to try the old way once more. Yet, with one to three gallons of cream and a revolving churn, it might be well to try a weight power. But let every person test such a power one month before he purchases—as we have seen weight powers make a lively splashing with a churn filled with water, but as soon as cream was introduced, the power was quite insufficient to work the churn. There is as much difference between churning cream and water as between a goblet of common water and a dish of ice cream of a hot day in August.

PLANTING YELLOW LOCUST.

Mr. T. C. Peters read the following paper:

To those farmers who think of starting a grove of the yellow locust, now is the time to prepare seed for propagating the plant. It is much the wisest and best way to start the plant in a nursery, and next spring to transplant to the intended grove. It is a valuable timber to grow, but the borer has become so troublesome in the older sections of the country that it will be advisable to start the planta-

tion in worked ground. In preparing the seed we have been in the habit of pouring boiling water upon it, and let it stand twenty-four hours, then drain off the water, and pick out all the seeds which have changed to a whitish color, and plant at once in rows in well-prepared ground for the nursery. Repeat the operation upon the seed; the second, and probably the third time, it will all be changed and ready to plant. Care should be taken to keep the plants clear from weeds or grass the first year, and the seed ought not to be planted until after corn is up, for fear of frost. The next spring the seedlings will be large enough for their final transplanting. In Kentucky we saw a grove started which promised good results. After the corn was well up a locust tree from the nursery was planted near ever fourth hill of corn in the rows crossway. Most of them grew, and where they did not fresh ones had been planted. The next year little was done except to level the land with a heavy harrow; the third year a plow had been run once between the rows, in the middle, to break the roots. A dense growth of young trees was the consequence, and the grove promised a splendid growth of locust and young hickory. The trees might be planted to advantage among the pines in South Jersey, and in a few years they would get such a possession of the land that the pines might be cut out. If so treated there would be little trouble from the borer. Thousand of waste acres could thus be made valuable land for its timber at small expense. If we owned much of that kind of land, we should start a nursery this spring, and plant out freely right among the pines next year.

An Improved Horse Harness.

Mr. Hiram Pennock, of Lyndonville, Orleans Co., N. Y., showed a contrivance, mostly of iron, for yoking horses and making the draught even and equal on both under all circumstances. It was examined by Messrs. George Geddes, S. E. Todd and others. Mr. Geddes thinks well of the principle, and the yoke was left with Messrs. Fuller and J. C. Thompson for trial in the field.

Market Gardening.

Mr. S. L. Sage, Corry, Pa.—Allow me, a stranger, young and inexperienced, to trespass upon your time and patience by asking a few questions which, though simple and of easy solution by older heads, are of importance to me, inasmuch as I ask for practical information, intending to put into practice the teachings and advice ot

your most excellent organization. I am young, and just ready to begin the active operations of life, assisted by a younger wife; and, paramount to all other aims, I am anxious to begin life at the right point, and for this reason I address you. I am situated about a mile from the busy little city of Corry, upon a farm of thirty-five acres, the most of which is yet incumbered with logs and stumps, only four or five acres being in condition to cultivate. From my earliest youth I have always had a fondness for agriculture; and this spring, through the endeavors of a kind father, I find myself in possession of enough land, I think, which, if properly employed, might be made remunerative. The soil is a pine loam, mixed in places with gravel, and nearly all in the state of virgin purity. Upon the south end of the farm is a sidehill, with a slope of about forty-five degrees from a level; and this would be, I have imagined, the place for hot-beds. My intention is to become a gardener, and, as fast as possible, bring into this use twelve or fifteen acres of the farm, allowing the remainder to lay in pasture and meadow. I wish to inquire: 1. If from one and one-half to two acres of cabbage would pay upon such land, and near the city in question. There are some thirteen hotels in the place, beside numerous eating-houses and restaurants; and the place contains, I should think, 10,000 or 12,000 inhabitants, and is growing very rapidly. 2. Would it answer to put cabbage out by the 25th of May, in hills of four to six seeds in the hill; and would they mature for winter use? 3. What would be the process of raising "onion sets," as commonly used in this country from the seed? 4. Can the Club inform me where I can get poppy seed, and whether there are profits to be made in raising opium? 5. Can the Club inform me if it would be advisable to raise cabbage and onions at this point for New York or Philadelphia markets? We have the A. and G. W. R. R., the Philadelphia and Erie, the Oil, Cr. and A. R. R., and the Buffalo, Corning and Pittsburg R. R. radiating from our city; and with these facilities for transportation, would it pay to engage in cabbage and onions, &c., for the large market? 6. Would it pay me to put in hot-beds upon the sidehill, say 75x300 feet, and six feet deep, covered with glass, with late improvements for removing the sash? My query is whether six feet is too deep or not, with the top-soil replaced in the bottom in order to retain strength of soil, and yet give me room to work inside with it covered by the glass? I omitted to mention that there is a good stream of water at the foot of the hill, which runs a good saw-mill, where I can make all the

lumber necessary for my purpose. 7. Will the Club inform me if it would be profitable to raise tomatoes for the large markets also? Perhaps I have written too much for the patience of your Club; but I am anxious to learn all I can.

Mr. J. B. Lyman.—The case of this young man in pursuit of knowledge might be disposed of in one line by sending him Fuller's answer. Get Henderson's Book on Gardening for Profit; but he is young, his wife younger, his soil in a state of virgin purity, his hill-side has a pitch of 45°, he is anxious to begin life at the right point, and wants to learn all he can. We exhort Mr. Sage not to be disheartened if he finds difficulties, not to give up if his cabbage don't head, and the young wife not to cry if the baby doesn't have a lace bib. To the questions.

1. Don't go deep into cabbage to begin with. You have to know cabbage as Peter Henderson does before it will make you rich as it has him. Your land is not now rich enough to make a market garden.

2. That is not Henderson's way, nor the practice of any of our great cabbage growers. They start in beds and transplant.

3. Onion sets also are a very exacting crop and risky. Why not get the seeds and sow in the usual way, then sell the big ones and keep the small ones over for sets and for seed next year.

4. The Club cannot inform you where to get poppy seed, and we discourage opium growing. Enough of corn is made into whisky, enough fruit into brandy, enough hops are grown for lager. If Mr. Sage really means to begin life at the right point, let him commence by growing food, not poison.

5. We do not advise sending cabbage and onions 300 miles by rail when you have a town of such size within a mile.

6. You don't want hot beds now.

7. You will not find it profitable to raise tomatoes for the large markets, they will not bear transportation to distant cities; you will get them in when everybody does, and they will sell for nothing; the middle men and hucksters would get it all if they did sell for anything. Now let us look into your case a little deeper. You have thirty-five acres, some of it is poor and wild, a few acres are smooth. You want to begin with a crop that will stand rough land. We advise late potatoes. Get them in at once. As soon as they come up, bury them again; then do nothing to them but kill the weeds till digging time. Meantime, engage all the manure you can in

Corry, take all the livery stables have, haul it home and compost it. Sleep with Peter Henderson under your pillow, read him seven times through, and next March you will have two elements of success as a gardener, first, all the theoretical knowledge that you can remember, and second, a big manure pile.

Adjourned.

May 25, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

INSECT PESTS—VARIOUS WAYS OF EXPELLING THEM.

To get rid of the little striped bug on squash and cucumber plants, Mr. Edmund Butcher, of Hornellsville, N. Y., gives the following receipt: Make the hills about ten inches in diameter, plant the seed in a circle, and in the center plant four or five beans. When the vines are out of reach of the bugs, the beans may be cut off or transferred to another place.

For lice on cattle or sheep, he says: Feed sulphur; I used sulphur in England and for more than twenty years in this country, and always with good results. For a horse or cow give about a tablespoonful in any feed twice a week, for two or three weeks, and you will have similar pleasant experience to relate. To my sheep I give the same medicine in the fall, when the sheep first come into the yard, mixing a tablespoonful of sulphur with a pint and feed it to them twice a week for three or four weeks, and at shearing time you will have no trouble with sheep ticks.

The following is his cure for yellows in the peach tree: Apply a tablespoonful of salt, saltpetre and potash combined together in equal weight. Mix it in the ground with a hoe, about eight inches from the trunk, about the 1st to the 10th of August. This disease is caused by great numbers of insects, too small to be seen by the naked eye. Piercing the roots, sooner or later the tree withers and dies. There was, in 1861, an orchard of 400 trees, on the Jones estate, near New Brighton, S. I. They had been standing twenty-two years, every tree perfectly healthy. Mrs. Jones said her husband took the receipt from an old horticultural work that seemed to have been lost sight of. The trees have annually been strictly treated as above, have become large trees. In good years for that fruit, they bear five bushels of peaches each. All peach trees, till four years old, require cutting back, to keep them healthy. They grow too much wood.

He has a preventive for the borer less troublesome than Dr. Trimble's prescription, to dig them out with a wire. Here it is: The best remedy I have seen is to make a little bag and put a piece of soap in it and place it securely in the crotch of the tree, so it can drip down the trunk with the rain, thus the trunk is always supplied with alkali and grease. No borers will be found infesting trees thus treated. August is the month most of the new hatched worms enter the trees. Their fresh borings will be seen around the tree. I suppose the egg is deposited some time before. The borers of different trees transform into different varieties of bugs. The quince become the small brown snapping bug; turn them on their back they will snap up and turn over. The apple borers become a speckled bug.

Mr. D. Carpenter, of Forest Grove, N. J., furnished *his* recipe for dealing with these destroyers of the infant vines. He said: The safest and surest remedy I have ever found is fresh charcoal pulverized. Dust it on the hill when you put the seed in, and as soon as the plants are up dust them plentifully. If washed off by rain repeat the operation. Thus treated, the plants are perfectly safe. I have seen all bugs disappear at once on the application when the plants were almost covered with the bugs. There is no fear of injuring the vegetation by use of charcoal.

Mr. E. D. Benedict, of Fairport, Monroe county, N. Y., gave his ideas in getting rid of striped bugs as follows: I notice in your last session an inquiry for a remedy to prevent striped bugs from destroying vines. I beg leave to give mine, which I have found successful in all cases, both of striped and common squash or pumpkin bug. Take coal tar and saturate corn cobs, and place them in the hill close to the vine, not touching the plant, and I will warrant not a vine will be destroyed by bugs afterward, no matter how many are on at the time of the application, they will surely leave to find a sweeter home.

Thrifty Peach Trees.

Mr. S. Sayler, who was present, from Alligan, Michigan, eighteen miles from the lake, gave some account of the peach prospect in that locality. He said he had known orchards of these trees, which, during the past thirty years, never failed to produce good crops. The borer does not torment, and theives break not through to steal. Besides, that section of country is capital for most fruits, and, in the opinion of the speaker, it was really the place to which young men

who want to succeed in life should hasten at once. It is also a good locality for wheat and other cereals.

The Chairman was glad to hear that there is a place where the peach, of which, as he grows older, he grows fonder, is long lived.

Mr. T. C. Peters said that in Virginia peach trees do not readily die out. He had known them to bear well for a score of years or more.

Milk Pans.

Mr. W. A. Shepard, of Randolph, N. Y., wrote to know if zinc is safe to use for pans to set milk in, and whether it would probably last as long as tin for that purpose.

Mr. T. C. Peters, an old dairyman of long experience, replied that zinc makes a good pan, and there is no danger in using pans of this material.

Mr. J. A. Whitney begged leave to disagree, and recommended tin pans as much to be preferred.

Mr. D. B. Bruen remarked that for the purpose indicated there is nothing like glass. Pans made of this material will prevent the contents being injured by the action of electricity; and, though they cost more at the outset, they are much the cheapest in the long run.

Mr. T. C. Peters confirmed this opinion, and stated that glass pans are used in England with great success.

Best Implements for Onion Culture.

Mr. A. M. Knapp, of Poultney, Vt.—I am growing farm and garden crops, and many of the necessary tools and implements are not kept here. I want an onion-weeder, but do not like to send money for a thing I have not seen and which might be worthless. Have any of your club used the Comstock hand cultivator and weeder? If so, please report the results. I wish to know if it will pay to buy this machine to cultivate one acre of onions annually. I have been trying to get the Hexamer prong hoe, but do not find it here or in Troy.

The Chairman.—That prong hoe is one of the best implements I have ever used, and it ought to be more generally known.

Mr. J. B. Lyman.—If he has an acre of onions, I advise him to get the best hand cultivator there is. I am not prepared to recommend Comstock's as better than others, but it is good enough. The great onion-growers of Wethersfield, who have produced the best crops of

any farmers for a hundred years, have reduced the labor of the onion field to a nicety. They say that with the common old style tools it took eighty days' work per acre to put in, cultivate and harvest a crop. With the best modern tools it can be done with the work of fifty days. Thus, for onions alone, a good outfit of implements would be worth thirty dollars a year on each acre cultivated. But there is no tool known that supersedes the thumb and forefinger. One advantage in such crops is that boys and girls that cannot do half a day's work at common farm labor can equal or surpass an athletic man at onion weeding. When that kind of labor is abundant, such crops pay. The best cultivators go over their beds just as many times as their condition require, but in most seasons twice is enough.

SOUTHERN STRAWBERRIES.

A gentleman of Fountain Creek, Tenn., forwarded specimens of strawberries grown in that vicinity. They were of the Wilson's Albany variety, and as large as the average of good sized berries selling at thirty and thirty-five cents a quart. He said he emigrated there in 1867, and was told the climate was too hot for strawberries; but he had found it quite the reverse. He also gave some account of his vineyard of Concord vines three years old. This spring they are heavy with bloom.

Apropos of this subject, Mr. A. S. Fuller wished to inquire why it is that no large sized berries ever find their way from the sunny south to the New York markets. Are we to infer that the berries grown there are all of an inferior quality and diminutive size?

Mr. T. C. Peters.—I was in Macon early in April, and I never saw finer strawberries that tempted the palate there. I suspect the Southern people have the good taste to eat the best themselves and let the Yankees have what is left. In Connecticut it is different. There it is the custom to sell everything they can sell and eat everything they can't sell.

Dr. Hallock.—If Mr. Fuller will walk with me up Third avenue after this meeting, I will show him in the grocery stores that abound in that thoroughfare, as fair specimens of this delicious fruit as he ever laid eyes on, and from south of the Mason and Dixon line too. I speak with authority, because before coming here I lunched on a quart of them.

Mr. H. P. Williams.—My duties take me into the markets considerably, and I am obliged to confess that the poorest strawberries I

see are brought from the northern part of New Jersey, about ten miles from the place occupied by Mr. Fuller.

Dr. Isaac P. Trimble—If Mr. Fuller had been with us at Hammontown two or three years ago he would not talk so wild. I have seen this great city of New York flooded with strawberries all from south of Philadelphia.

William Gulliver on Colorado.

This gentleman having returned from the far west, gave some account of what he there saw: I desire to say a word in relation to other fruits, grain and vegetables grown in the valleys at the base of the Rocky mountains. First, in relation to the strawberry. This delicious fruit is to be found in large quantities, not only on the plains at the base of the mountains, but high up; it may be found within a few feet of the regions of eternal snow. I have enjoyed myself sliding down snow-drifts on the fourth of July, and when fatigued with the amusement, would sit down in the grass near the edge of the snow, and gather as many strawberries as I could eat. They commence to ripen about the first of June, and continue to blossom, bear and ripen, until about the middle of September, and during the entire time the vines are very full of fruit in the various stages of advancement. The berry is small, very sweet and luscious. Whether it should be as prolific, or the fruit as finely flavored if transplanted in another climate, I do not pretend to say. I only know what I know, and that I say. There are also to be found, growing in great abundance in the valleys at the base of the Sierra Madre, immense quantities of choke-cherries (a very superior kind of wild cherry, and a powerful astringent), raspberries of a superior kind, plums, grapes, gooseberries, black, red and yellow currants, juniper berries, whortleberries, hops and so on. Wild oats, timothy, and a beautiful species of clover are to be found on the table lands, and in the passes. In relation to the vegetable creation, the story I wrote to you some time ago about the turnips was no friction. That turnip could not have been crowded into a peck measure. Wheat weighs seventy-two pounds to the bushel. Several acres of potatoes on Mr. Clarke's ranche, five miles above Denver, were averaged, and it was found that the average was one pound apiece, that is for each potato. I bought a watermelon from which five of us partook heartily three different times, and then threw more than half of it away because it became sour. I have seen the Mr. Clarke referred to above cut up three heads of cabbage for sour-kront, and they filled a flour barrel.

Planting Corn too Early.

Mr. David Petit, of Salem, N. J.—In your proceedings of May 4, L. A. Robertson, Delaware Station, N. J., inquires: "What's the matter with the corn? It comes up very unevenly in regard to time; that that comes up latest looks feeble and unhealthy, and by the time of the last plowing is not more than six inches high, the ends of the leaves dying, and on being pulled up only a few slender roots are found near the surface of the ground."

As I have had experience with corn answering to the above description, permit me to offer a few remarks thereon, with a remedy for the future. This appearance, with the result described, rarely happens on sod ground, or on sandy land, but prevails on land that has been one year or more under cultivation. Manure will not remedy it, as has been suggested, as I have tried manuring in the hill without effect; nor is it caused here by worms, as A. S. Fuller says. The real cause is planting such land too early; when cold and wet weather comes at the time or soon after, the corn comes up lousy at the roots, from which it rarely recovers. The roots that are lousy die in time, which affects the leaves as described above, and unless the corn is hilled and is followed by wet weather, to enable it to send out higher roots, the corn may as well be plowed up. I once had a small field of stalk-ground well manured in the hill and planted early with corn, which came up so lousy at the roots that the crop failed entirely. Next year I planted again later with the same result, as the *ground* had become lousy. I then planted with beans, thinking they would escape, but the lice took them also, and even the weeds were lousy at the roots. I then cultivated the ground without any crop, and succeeded in exterminating the pests. The same land has been cropped the five succeeding years without being lousy. A few years ago I crossed Newcastle county, Delaware, into Chester county, Pennsylvania, when, to speak within bounds, more than half the corn on the route had the appearance of that described by your correspondent. This was about the time it had attained its full size, and it was then of various heights, from a few inches, and dying, up to or near the height of ordinary corn, with every hue of unhealthiness. I would not have such land planted early for me, if I could have it done without cost. The remedy is to plant later.

Mr. A. S. Fuller.—This is just such a report as we would expect from a section of the country where the farmers advocate and prac-

tice shallow culture. Gardeners and pomologists all know that stunted plants of all kinds are very likely to become lousy; in fact, this is one of the sure signs of poor, shallow soils. If our correspondent had not been such a prominent advocate of shallow culture, he would not have been so sure of the cause of the disease and insects named.

NEGLECTED APPLE ORCHARDS.

The regular paper of the day was on this subject, and was read by Dr. J. V. C. Smith, ex-Mayor of Boston: Melancholy wailings have often been heard at the Farmers' Club, over the sickly condition of apple orchards in all the northern States. Certain it is, the trees have a shabby appearance, and the small quantity of fruit they produce in their latter days, compared with their former fecundity, has become a topic of grave agricultural interest. Unfortunately, an impression has been extensively propagated that apple trees have become fatally diseased, which accounts for their small yield of imperfectly developed fruit. Another cause of deterioration is charged to insects, so multiplied that their extermination is represented from some quarters to be hopeless. We believe there is unnecessary alarm, and that neither of those causes are so prominent or beyond control as frequently represented from respectable sources. Good apples in abundance, fair and cheap too, were abundant thirty or forty years ago. The trees were then vigorous; they are now old and neglected. They ought to bear till they are nearly 100 years of age, without material falling off; and they would, were the same amount of care bestowed upon them which is usually given to them when young. Pruning is quite neglected. That is a medicine quite indispensable to a healthy condition of the tree. In their youth the top is open and free, so that air and sunlight play freely over the branches and leaves. As they advance in growth the limbs multiply till, if allowed, the top becomes a compact network of outshooting limbs, interlaced and betangled, stiff, resisting, and almost thorny. Respiration as well as evaporation from the surface of the bush is thus interrupted, and in consequence of the denseness of the hedge, the sun's rays can not enter to exert their appropriate influence on those parts, quite as important in vegetable economy as on the bodies of animals or man. With such a condition vermin find secure burrowing places. Their destructive agency, by sucking the circulating sap, the vital fluid of all trees, wounding delicate tissues near dividing branches, where the

scarf skin is most delicate and tender, with ovipositors in some cases, or by the direct introduction of their progeny to gnaw into vitalized places in others, where their undisturbed increase seems to defy extermination. But a vigorous effort would soon modify, and ultimately give a determined orchardist complete ascendency over two acknowledged sources of deterioration. Next, from long neglect, especially in old orchards, the trunks near the ground become grass-bound. The snug-fitting turf is like a ligature. Beside affording a nestling spot for vermin, especially such as feed on the sap at that point, the ligature interferes very much more than may have been expected, with the free ascent of the blood of the tree, the sap. That circumstance alone is no small affliction. The remedy is as simple as the fact is apparent. Remove all such intruding embarrassments by keeping the ground free from intruding weeds, and hard wiry grasses. Some incidental discoveries in regard to the kind of materials best suited to the circumstances of trees as fertilizers; or, in plainer terms, food, show that animal remains are particularly beneficial to their development. Trees of an ornamental character in cemeteries are usually more thrifty than the same sort in other localities where animal products are not accessible to the roots. The coffin which originally held the remains of Roger Williams was so completely invaded by the roots of an apple tree that the entire anatomical shape, dimensions, and position of his bones were secured by the tendrils, and the cast of that celebrated man's skeleton, thus taken in an unheard-of manner, is at present a museum curiosity. Whether the phosphate of lime in the bones, or the elements set at liberty by the decomposing tissues, were sought by the tree, is uncertain. The presumption, however, is in favor of the phosphate of lime. Formerly, when there were dead animals about the premises, it was customary to throw them into a stream that would waft them away, or they were buried remotely, to avoid a nuisance. That was a waste which no well informed cultivator of fruit trees now permits, because when covered up in the circle of their roots they are quickly secured as nourishment, to the immediate perceptible benefit of the trees. This suggests the question, would it not be good policy to manure fruit trees of some varieties, especially the apple, with any and all kinds of animal remains that happen to be at hand. Thus offal from slaughter houses, scraps from currier shops, market house waste, and fish, if easily obtained. Certain it is, as far as observations on that point have been made, animal matter is seized upon by the absorbing root-

lets, and the rapid growth in very rough and hard ground, among stones, to reach decaying flesh, and especially bones, is a plain indication of a source of nutrition not to be lost sight of when circumstances are favorable. That mode of enriching the soil where trees stand which are especial objects of our solicitude, is worthy of consideration. There are such a variety of opinions respecting that devouring plague, curculio, it is dangerous ground to approach for fear of exciting discussion. Give swine free access to orchards of all kinds. If they should fail to crush each individual insect burrowing in a fallen apple, their untiring propensity to plow the soil, in search of food, must greatly disturb and interfere with the concealed enemy while in the ground. Instead of charging the present sickly condition of orchards to modifications of climate, deterioration of the soil, or laying too much stress on the invasion and diffusion of the curculio, we might, with some show of propriety, review the neglected manner of attend, ing to the culture of fruit trees by farmers in general. We have been occupied with excitements in all directions for some years. Good farmers formerly looked at everything themselves, over the whole extent of their grounds. They now have foremen and delegate powers which our forefathers managed exclusively themselves. They knew little or nothing about banks or railroad stocks. What was not consumed was sold, and the crop that promised best in market was carefully managed. While the soil was new, and an abundance of those elements in the composition of fertile places had not been exhausted on which both plant and fruit essentially depended, less personal care was required. But when those resources were beginning to diminish in amount, neglect often followed as an unmistakable cause of further deterioration. There has been no period since the settlement of this country when orchards presented such a sickly, poverty-stricken aspect as now. A little neglect was favorable to the increase of insects. While the exhausted earth remains, year after year, unsupplied with appropriate food for the trees, every imaginable destructive influence has been going on rapidly to actually kill them. Most of them are feeble and in the decrepitude of old age. Starvation, parasites, strangulation and the ceaseless attacks of vermin upon circulating juices actually threaten their extermination. Scarcely a single apple escapes the visitation of an enemy. The cure and renovation of orchards are to be brought about by active personal effort. That is the medicine required, instead of philosophical dissertations on probable causes of their appearance. It is discreditable

to the intelligent course pursued in regard to crops in general and the humanity of the age in the kindness manifested toward domestic animals, that fruit trees have been allowed to shirk for themselves. They cannot be kept up to a full standard of excellence and yield as they might be without a vigilant superintendence. There is even a culpable neligence in failing to set out young trees, annually, to meet the contingencies that beset old ones. Should they become too numerous they could be removed without diminishing the resources of the owner, as the developing new trees would more than make up for a loss in numbers by their increased prolific vigor. In a word we cannot divest ourselves of the opinion that a diminution and deterioration of the apple crop at the north, and to some extent west, is due to the want of attention which must be bestowed on all sources of agricultural industry, as a country advances in age and population, to keep productiveness at a satisfactory, renumerative standard.

Mr. T. C. Peters said the paper just read embodied some very important suggestions. He would, however, before moving the thanks of the Club, beg leave to relate a little of his own experience. He had seen and known an orchard which was planted among the stumps of the farm in Western New York more than fifty years ago, during which time he had been personally familiar with every tree. When the trees were young, and before the roots filled the whole surface of the earth they grew vigorously. Nature provides means of supporting and reproducing herself. When the foliage annually produced upon a tree is suffered to fall and decay at its roots there is little danger of a vigorous growth and an abundant production of its fruit. It is only when man interferes with the operations of nature that she begins to show her dislike at his efforts. The increase of limbs and roots necessitated an increased supply of food for sustaining vegetation, and enabling the tree to perfect its fruit. Having a large pile of leached ashes on the farm, he had a quantity drawn and put around the trees, nearly or quite a horse cartload to a ton. To this he added the rotten chips from the door-yard. The result was a new tree in appearance. The old bark fell off, and was replaced by a new, clean bark, and greatly improved fruit. The fruit having become wormy, he turned in and pastured hogs in the orchard, which, in a very short time, cured much of that complaint. He fully indorsed Dr. Smith's sentiments, that the cruelty to orchards was quite as palpable and inexcusable as cruelty to animals. It should be borne in mind that this orchard is in fine wheat land, and that

now, at more than fifty years of age, it is healthy and vigorous, and is apparently good for another fifty years. Where orchards are planted on potash or soft water soils, the trees, after a few years, are sure to die, from no defect of lime, but lack of nourishment. They must have lime in some shape; and unless in the soil, it must be given by top-dressing around the tree. Much the best method of feeding trees where lime does not exist in the soil, is to place crushed bones or coarse bone dust at its roots. If there is not a supply on the farm, or it cost too much to get them, the next best thing is to get the Navapa guano, which contains about sixty per cent of bone phosphate. This mineral will be found of great benefit on all kinds of fruit trees or vines, where the soil is not a hard water, or lime soil. Too much attention cannot be given by the fruit-grower to the nature of the spring water where it is proposed to plant trees or vines; for no one thing is more certain than that fruit or vine-growing has never been permanently prosperous except in a limestone soil. Lime is the key-stone of the arch in fruit and grape cultivation. It is of no use to plant trees or vines where that mineral does not exist in governing quantities in the soil; disappointment will follow, in the end, attempts made in any other kind of soil.

Dr. Isaac P. Trimble.—The remarks of Dr. Smith and Mr. Peters must be understood as applying to inland farms, remote from great cities. There are a great many unproductive orchards near New York and Philadelphia; but will it pay to cut them down and plant fresh apple trees in their place? I think not. The area is too valuable to occupy it with a precarious crop. Two years in five an acre *may* give $500 worth of apples. But, in the hands of a skillful farmer, it can be made to grow $500 worth of cabbage five years in five. Fruit growing is a business, and has its secrets and its mysteries. Let those who understand it follow the business of the orchardist; but not the regular farmer, who will neglect his orchards for his fields at critical periods.

On motion, a vote of thanks was presented to Dr. J. V. C. Smith, for his valuable paper.

How to make Farming Instructive.

W. C. Crosby, Bangor, Maine.—Now, what can be done to render the business more agreeable, or in other words, to give the farmer more active and profitable thoughts—active that it may be agreeable, and profitable, that speculation may not lure him from the plow?

My answer is, he must educate *himself.* I don't mean by study of books principally. Books in farming are very useful when the student has taught himself how to use them—how to separate the grain from the chaff; but the education I propose is that which every man in any sort of business gets from it, and others who are engaged in the same occupation. To obtain it he must cultivate a habit of observing—especially of observing those matters having a near or remote connection with his calling; and of course this habit implies or forms a habit of reasoning upon or inquiring into the causes of the things he observes. How, then, is this habit of observation and reasoning to be brought into being? Before proceeding to answer, let me say a word as to my own experience. Thirty years ago I was at the head of a large farm; having been brought up on one, I had, of course, some knowledge of my business. I believe I was called a pretty good farmer. I thought I did pretty well myself. I don't think so now. For the last twenty years I have had nothing to do with the farm; but I have had a garden of about one-tenth of an acre. My aim has been to so manage this as to obtain the greatest amount of products from my limited area—cultivating most, but not all of the common garden vegetables and small fruits. The cost of labor and manure being of minor importance—quantity and quality of the whole being preferred to size of single specimens. From this experience I believe I have learned more of matters one who cultivates the soil should know, than I did on the farm when I managed ten acres instead of square rods. Not that I have learned much new; for I find that every fact and truth I now believe I have attained, opens up a vista of at least two other facts that I have not reached.

Now for the mode of acquiring a habit of observing the things an agriculturist should see and study.

Let neighborhood clubs of from five to ten farms be formed—not more than ten should make the association. Each member to select a quarter of an acre of good land, and resolve that he will make that spot produce the most in value which his skill, labor, or means will allow. If a quarter of an acre be thought too small an area for his best efforts, let it be enlarged when the cultivator has succeeded, not merely in bringing it to its highest point of fertility, but in extracting from its fertility the largest amount of specific crops. I think most men will find a quarter of an acre will afford scope for the exercise of all their spare care, thought and labor for years. Let

the majority of the club determine what crops or vegetables shall be cultivated—every member to feel bound to cultivate all these, and at liberty to add others at his pleasure—every man to manage his business in his own way, subject only to the condition that at the stated meetings of the club, when each member's "school" patch is to be examined by all, he shall be ready to state *what* he has done for each variety of plants cultivated, and *why* he has done it. If one has planted his squashes in hills because his father so taught him, or another has placed each plant by itself becaause he can thus see that each has its due proportion of ground to take root in, and sunshine and air for its leaves; if one has cut off all laterals from the main branches because they draw away the sap and strength of the plant, and another has left them, or some of them, because they assist the principal branch in sending down roots from the joints, and thus keep the whole in place, undisturbed by winds, let each give his reason, whether it be habit, theory, or the result of his experience? and to all let there be given a generous, and respectful consideration. This is, of course, a mere outline. Those who care for such matters can easily fill up the plan with constantly increasing details of interest and importance. A valuable aid or instrument in this study is a pocket lens, which will cost about seventy-five cents. Let each member procure one for himself, and all his boys and girls, too, if they take an interest in the family work; make the school-patch a frequent topic of conversation among the younger members, and enlist their thoughts and feelings in this emulative contest. Soon will follow a desire for the better and accurate information embodied in books, and then these will be of great usefulness, and both the old and the young will find pleasure and intellectual exercise in the, as generally managed, dull and monotonous employments of the farm.

Cure for Hen Cholera

Nancy P. Mills, Chandlerville, Ill.—I see a request for some one to prescribe for hen cholera. Use the following receipt: To a pint of corn meal add a tablespoonful each of alum and black-pepper; beat up fine. Feed poultry on that and you will have no cholera. If any are so bad they cannot eat put it in their mouths, and push it down their throats with the finger. This treatment has never failed me.

New Uses for Husks.

A gentleman, from Richmond, Va., said he was engaged in the husk hetcheling business. He uses up 1,500 tons of corn husks

annually, and gives ten dollars a ton at the crib or twenty dollars baled and delivered. About one-third of the bulk becomes waste. Two-thirds is sifted and baled for use by mattrass-makers. He gets forty-five dollars a ton in New York, and has engaged to deliver to one firm 800 tons. He wishes to know how this waste may be made available; will it serve the paper-makers? Is it useful for any purpose other than as manure?

Prof. James A. Whitney.—Some years ago an Austrian discovered a process by which a kind of flour was extracted from corn husks by boiling. It was made into bread and fed to the troops. The fibrous remains were converted into the pulp of paper-makers. As to this man's waste, its value depends upon the length and cleanliness of fiber. If very short and dirty, and full of silks and stubs, it is doubtful whether it can be of any use in the arts.

Presentation.

Miss Cornelia Beach, Montezuma, N. Y., presented to the Club an agricultural picture composed of various varieties of grain, skillfully grouped and combined so as to form a floral wreath. The wreath was very much admired by the members. It will be placed in the rooms of the Institute. The thanks of the Club were presented to Miss Beach for her beautiful present.

Adjourned.

June 1, 1869.

Nathan C. Ely in the chair; Mr. John W. Chambers, Secretary.

Business Habits in Farming.

Mr. D. B. Bruen read the following paper.—The reason why the knowledge and habits of the common farmer are lightly spoken of is because their management is so slipshod. They do not mend the plow as soon as it is broken, but wait and take the most precious time of the day in the most important part of the year. Then, when the plow is mended, the harness is found defective. Another half day is lost in repairing that. The merchant who carries strict business habits to a piece of land manages better. Much has been said as to the success of business men turning farmers. In the southern States it has always been the ambition of every man to become a planter, and it is almost invariably the case that the merchant or other business man, when he accumulates sufficient wealth

and turns to be a planter, always succeeds far better than those who have been brought up professional planters. I well recollect, some thirty-five years ago, on a voyage by steamer through the Sea Islands from Charleston to Savannah, we were obliged to stop for the tide at the plantation of Mr. Seabrook, at Edisto Island. Mr. Seabrook invited the passengers to his elegant mansion. Among them were a large number of planters. John Stonney, a merchant of Charleston and a large planter, was among the number. The conversation turned on the successful management of Sea Island cotton plantations. The line was strongly drawn between the management of men bred to plantation life, and merchants or business men when retiring from business and becoming planters, and it was conceded by every planter that the most successful planters were business men who retired from business to agricultural pursuits; that they brought with them close observation; with method kept accurate accounts with their plantation business as they had done in their business operations. Mr. Seabrook, although brought up with every advantage that education, wealth, and plantation life could give him, remarked that he and all other planters had learned more from merchant planters in the proper management of negroes, cultivation, and production of a superior quality of Sea Island cotton than they had ever before known; that the improvement he had made from their example in the quality of cotton raised on his plantation had placed it in the market at 100 to 200 per cent greater value than the market price, which was at that time twenty-five to thirty cents per pound, while he had refused seventy-five cents for his entire crop. Mr. Seabrook's success was not an isolated case. Mr. Seabrook named a planter who had sold his cotton at two dollars per pound. One of the passengers in the party, who had just returned from Europe, said that he was in the manufactory at Manchester when that cotton was used, and said that the manufacturer told him that it was the most profitable cotton, at that price, of any he had ever used; that he could manufacture fabrics from it of so fine a texture that they would pay him a larger profit than any cotton of an inferior quality and corresponding price as to quality. The same rule will almost universally apply to all business men, who have had method and energy enough in their business transactions to acquire fortunes, and retire not too bookish and scientific for practical working men. They learn the proper use and value of all fertilizers, use the most approved agricultural implements, keep them and all their farm stock well housed, not forgetting

proper care and shelter for the poultry, never put anything off until to-morrow, and do everything now that can be done now, and beat their neighbors—not because they know more, but because they make a more systematic use of what they know.

Dr. Trimble, in comment, said Mr. Bruen is one of those men who show their faith by their works. He has as nice and clean a garden, as well kept grounds, and a hennery as tidy and as profitable as can be found in the suburbs of Newark.

Growing Onions.

Mr. Arthur E. Smith, Wallington, Lorain county, Ohio.—My father has a farm, a part of which is very rich muck land. He let me take about three-quarters of an acre of it, but I did not have the control of it this year; but next year I think I shall have the whole management of it. According to your Club reports, it is just the land for onions; and I think next year I should like to put most, if not all of it to onions. Now, will you please answer these questions for me: What kind of seed had I better get, and what tools for the raising of onions, and where shall I send for them?

J. B. Lyman.—Such youth as this should be encouraged by everything that can be uttered here, and at the risk of saying what has often been said I will advise him. For seed, he had better get the red Wethersfield; it grows a little larger, and with more certainty than other varieties. The yellow Danvers is a prettier onion, and has less of the rank smell. There is also the white silver-skin, but it does not grow as large as the red.

The Chairman.—Many persons like the strong taste of the red onion; they prefer it to milder varieties.

Mr. Lyman.—For tools, let him get a seed-sower and hand-cultivator in one. They can be had at the implement stores; he will see pictures of it in the business columns of agricultural papers, and in the department report for 1866. The land should be manured this fall; no matter how rich it is in black soil, it needs yard manure. Plow deep and plow twice. Then, in the spring, plow again and harrow. If the land is not naturally underdrained his father should put in tile. Once in onions always in onions. It will not bear wonderfully the first year; better the next, and still better the third. There is no plant like the onion in that respect. The best that the country produces grows on gardens that were sowed with onions when Washington was President, long before Col. Johnson killed

Tecumseh; and they have given from 500 to 800 bushels to the acre ever since. He needs one of those light hoes, edged like a saw, that moves both ways. But no tool will permit him to dispense with thumb and finger work. The boys and girls in Wethersfield have a callous on their knees as tough as a horn. I have heard that when the onion season is over this scale comes off, and they use it for a soap-dish. If Arthur puts in three-quarters of an acre in onions, he will spoil the best part of forty days in work on the patch. Instead of selling all of them, he had better keep 100 bushels of the smallest for sets next year, and raise 200 or 300 pounds of onion seed. This may return him a dollar a pound.

Mr. Amos Gore, New City, N. Y., said that he did not pull the weeds out, but shoved them in with the finger.

Agricultural Chemistry.

Professor James A. Whitney, recently appointed chemist to the Club, read the following paper, indicating the points where physical science can be of greatest use to the farmer:

Chemistry is a science vitally allied with agriculture; for there is no development of plant life that does not involve its action, few occupations of tillage not dependent upon its principles. When the seed, bursting with moisture and quickened by warmth, sends its slender rootlet into the soil, and unfolds its tiny cotyledons to the sun, its nature and structure are altered, nor is the change in its form greater than the transformation in its chemical composition. In all the subsequent stages of growth, the forming of stem and leaf, of bud and blossom, of fruit and kernel, pod, capsule and ear, each is characterized by a chemical action that causes the constituents of the plant to assume new shapes and form new substances. In like manner in tillage, though we may do no more than stir the ground, the moisture that is thus caused to permeate it, the sunlight and heat that penetrate its recesses, the carbonic acid evolved by the decomposition of its organic matter the ammonia absorbed by its humus, all act chemically to modify its nature, supply plant food, and promote a vegetable life. After the harvest is gathered we know that the soil is not the same as it was before, because certain substances have been taken from it which must be replaced ere the same crop can be grown again with the same advantage. Being thus intimately connected with chemistry in all its varied relations, it is useless to deny that a knowledge of chemistry, teaching us the laws that govern and

the substances that enter into the composition of vegetation, enable us to better avail ourselves of those laws and to more readily supply those substances to the plant. Chemistry, like every other department of practical science, only tells us how me may act in accordance with nature. For instance, we are treating a soil that is sterile after a liberal appropriation of manure, we puzzle over the reason until an analysis shows the presence of copperas, a poison to plant as to animal life. Without further information we might be at a loss to remove the poison and renovate the soil; but the chemist, aware that lime will displace the oxyd of iron from its combination with sulphuric acid, suggests the use of that mineral, not as a manure, but as a chemical agent, and the problem is solved. The noxious substance is changed to harmless sulphate of lime and inert oxyd of iron, and crops grow thriftily. where they refused to sprout before. A similar illustration may be found in another use of lime, in the reclamation of swamps and peaty lands. Research has made known the existence in such soils of acids derived from organic decay, and not only hurtful to plants, but locking away from their reach the ammonia that would otherwise feed them. The chemist explains that lime attacks these compounds, neutralizes the acids, and liberates the ammonia, so that the scientific farmer, turning against Nature the force of her own laws, makes available by art for the benefit of his crops the substance that the natural chemistry of the earth had cunningly hidden from their reach. Chemistry not only tells how, in these and a hundred other ways, we may change and ameliorate the condition of the soil, but tells why and wherefore some soils are naturally better than others. For instance, when we learn that clay has the power of absorbing and preventing the washing away of certain soluable substances, and of abstracting from their solutions potash, ammonia, phosphoric acid, and other manurial agents, we can easily understand how it is that the productiveness of an argillaceous soil should be more stable and permanent than that of a sandy one through which the fertilizing matter will filtrate away. Not only does the art of the chemist thus in a great measure enable us to judge of the capabilities of the soil, to change its condition, and to trace the progress of its elements as they are transformed by the weird agencies of organic life, but it goes still further than this. It enables us, as well to seize these elements, some of them as volatile as the air we breathe, and to hold them fast until we are ready to apply them to the ground. Thus it is that knowing the sharp and odorus vapor that rises from dung-heaps

and stable floors to be the same substance that is most needed in sprouting stem and springing leaf, we add plaster of paris or dry muck to the mass, and fix the vapor to feed our crops, instead of allowing it to waste in the air. More than all, chemistry takes inert materials, made up of elements so firmly combined that the subtle strength of vegetable demand and the agencies of air and moisture can separate them but slowly, and in a few hours it converts the whole into manures so soluble that they may be at once assimilated by the rootlets and transmuted to cell and tissue and fibre. By these means the flint-like nodules termed coprolites, the refuse of fishes and marine animals that were fossils before man came upon the earth, and the stony deposits of Navassa, hardened under the rains of a hundred ages, are fitted for transformation in a single season into the structure of fruit and grain.

But why multiply examples to show the importance of chemistry in its application to agriculture? Is it not enough that, aside from the introduction of new implements and machinery, the great and acknowledged improvements made during the past half century in the art of husbandry, have rested upon chemistry as upon a foundation of stone. Witness the manufacture of portable fertilizers, the rotation of crops, the practice of green manuring, and even the feeding of cattle; for have not chemists told us the relative values of different kinds of food, for example, that five pounds of oil cake contain more nutriment than a hundred weight of turnips; and have not farmers, acting on theories like these, found them, by the stern tests of experience, to be correct. In the old times farming had only the chances of successful guess-work; now it has the certainties of applied science, and there is just as much difference between the two as between the old "scribe rule" of "cut and try," in building, and the geometrical plans of the skilled architect. A century and a quarter ago Jethro Tull taught that the roots of plants took up little particles of dirt and transmuted them into vegetable structures. How, with such teachings, could we be led to appreciate the importance of ammonia in solution in the soil. It is but little more than thirty years since it was a mooted question as to whether the elements of the ash of a plant were essential in the soil in which it was grown. How, until this point was settled, could the agriculturist see the importance of supplying potash or phosphoric acid or lime to supply material for the growing organism. But a knowledge of such truths once gained, the farmer proceeds to act understandingly upon the

axiom that the soil is simply a means by which certain materials are converted into other substances endowed with vegetable life, and capable, in their turn, of providing food for man and animals. Having spoken thus of chemistry and its applications, may not a few words be due to the chemists themselves, and the part that they may reasonably be expected to bear in the advancement of agriculture. And here it may be remarked, that this part will be quite different in some important respects from that held by the noted men who molded agricultural chemistry into a distinct branch of science, and gave us our most valuable knowledge on these topics. It was their mission to discover, their task to search out secrets in the great laboratory of nature, and to unfold them to the ken of others for utilization in practice, and they did their work well; so well that the opportunities for making great and startling discoveries is narrowed to finding out how to use the information we possess, rather than in extending the boundaries of chemical knowledge. In the infancy of the science De Saussure investigated with surprising care and accuracy the phenomena attendant upon the life of plants, and pointed out the bearings which these phenomena have upon the practical processes of tillage. After this, now nearly sixty years ago, Sir Humphrey Davy published his celebrated twelve lectures on chemistry in its relations with agriculture, and made many suggestions regarding the manner in which chemical truths could be usefully applied in farming operations. Although these writings produced but little effect at the time of their publication, yet by adding to the common stock of information and showing the importance of the subject, they prepared the way for those who, thirty years after, Boussingault in France, Liebig in England, and Professor Mapes in our own country, still further extended the limits of our knowledge regarding the growth and requirements of plants, the composition and capabilities of soils, the action and the nature of manures, and deduced rules for the practical application of such knowledge to the functions of the farm. This was their work. What they left undone in mere discovery, and that which they failed to accomplish in the generalization of principles, of course, remains to be completed by others. But this is only a small part of the labor, only a minute fraction of the opportunities of the agricultural chemist of the present and of the future. His great work must be to take the knowledge that now lies idle in the leaves of books in the unused products of the laboratory, in the truths laid down by scientific men but com-

monly unknown to the tillers of the soil, and to mold it into shape, supply its deficiencies by research into its detail, and apply it to the purposes of every-day life, common sense tillage, profitable farming. We cannot, in these days, learn much more than we know of the constituents of plants or the evil results of the absence of any one of them, for this subject was sifted some decades of years ago by Salm Horstmar, who found, for instance, that, although a plant might vegetate without silica, it would not have strength enough to stand up alone; that without lime it would die before producing its second leaf; that without potash and soda it would scarcely grow at all; that magnesia is necessary to its strength; and that without sulphuric acid it will produce no fruit. We cannot hope to add much to our knowledge of how water passes repeatedly through the structure of a plant, so that the quantity exhaled from it is often greater than the total rain-fall on the ground whereon it grew, inasmuch as Saussure found out all that seventy years ago. Pretty much all has been learned that can be learned of how ammonia passes into the roots in solution in water, and carbonic acid into the leaves in its gaseous form; and for this we have to thank such men as Boussingault and Liebig, who are old now, but who taught these things ere the flush of their young manhood was past. Neither can we discover again the doctrine of progressed manures, for that was set forth in this room from the lips of the eminent Professor James J. Mapes, in days when some of the younger members of this Club were boys, busy in the practical avocations of the farm.

As we have previously intimated, the opportunity for discoveries of this character is for the most part over. They constituted, as it were, the plowing of the great field of scientific agriculture, and the laborers who come after must be content to harrow and hoe the ground thus prepared, to plant therein the seed of patient and often humble research, and to gain in due time the rewards arising from practical utility rather than the triumphs of purely scientific progress. The agricultural chemist who schemes to make his mark, or to benefit the world by making some high-sounding discovery, may have a weary time to wait. But he who seeks to put to the best uses what has already been found out; who tries to learn and to make the true application of facts and principles already known, and who strives to supply the deficiencies of great systems or discoveries hitherto made by working out their practical details, will achieve a true and permanent success. He may miss the *eclat* that halos the names of the earlier

chemists who reaped the first harvests of fame. Yet he will know that it is through his efforts that the labors of those who went before are made really valuable to mankind, and agriculture is raised to the condition of an art resting upon and guided by a correct appreciation of natural laws and forces. It will be his task to make chemistry and common sense go hand and hand in the advancement of farming for profit and produce, for plenty and comfort; and, surely, in this there is enough to satisfy the most worthy ambition and opportunities for usefulness which no man need disregard. The writer has spoken confidently of what chemistry has done for agriculture in the past, and hopefully of what it will do for it in the future, yet we must not expect too much. We know how, twenty years ago or more, the theories of Baron Liebig were accepted and stretched in their applications to such an extent that many believed it only necessary to analyze the soil to fit a field for producing a crop with as much ease and certainty as a post hole is fitted for the reception of a fence post. We know how all this proved futile; how a chemical examination can only be a negative proof of the relative fertility of a soil, affording at the best presumptive but not positive evidence of the precise nature of the manures required. We know there are many problems in husbandry that have perplexed the ablest investigators, and many questions upon which chemists themselves disagree; as, for instance, in the case of gypsum, some saying that its value is due to its property of fixing ammonia, others that it should be credited to its lime, and others still that its sulphuric acid, by dissolving silica, has much to do with its efficiency, while none of them can tell why it is that gypsum succeeds well on some soils, and in some cases, and not in others. All this proves only that in the present state of our knowledge the practical applications of chemistry have their limits. It does not show that chemistry is useless in agriculture, and it ought not to prevent the community from making universal application of the general principles that chemists have demonstrated. It should not deter the practical farmer from giving a fair trial to the theories of the scientific man, and it will not deter the truly progressive tiller of the soil from trying on a large scale those experiments which, in the hands of others, and on a small scale, have met with any measure of success. The opinion has already been advanced that the true progress of agricultural chemistry will be found, not in a few great discoveries, but in many minor ones bearing directly upon the operations of the farm and the functions of

vegetable growth. For instance, as to the why and the wherefore of the action of gypsum; so that we may apply this substance with some absolute certainty of the result; the extent to which clover is superior to other plants as a green manure, and the chemical reason of its superiority; the periods of growth at which different plants are stimulated the most by various manures; the degree to which the constituents of plants are made to vary by differences in soil; the fixation of the fertilizing portions of liquid manures. These, and many other illustrations of like character, might be adduced to indicate the direction in which agricultural chemistry will find its greatest field for usefulness."

It would be pleasant, Mr. Chairman, could we for a moment close our eyes and see in the dreamland of the chemist the day that for the farmer is yet to be; a day when no tiller of the soil shall be so ill-advised as to mix lime with a manure heap, and drive its ammonia to the winds, or plow three inches deep when six inches of fertile mold lies below the path of the share—when men shall act in accordance with the basic truth, that agriculture is the noble mother of arts, founded upon and only developed to its utmost by the aid of the whole range of physical sciences. In that day the chemist and his work, sometimes derided as frivolous, sometimes avoided as dreamy, will not fail of the honor as the high priest in the temple of Nature, admitted to her hallowed mysteries, only that he bring out thence sacred truths, elder truths, universal and lasting wisdom, wherewith to bless the races of mankind.

Dr. J. V. C. Smith.—In moving a vote of thanks, and requesting of Prof. Whitney a copy of his admirable paper for publication in our reports, I beg leave to add that such productions show the advance we are making in true and scientific agriculture on this continent. Mr. Whitney's essay will be read, I am sure, quite widely in this country, and it will not fail to command some interest abroad. I am proud to be a member of an organization that from time to time can put forth such productions and do so much to stir thought and draw attention to the most valuable principles of physical science.

Mr. P. T. Quinn.—In seconding the motion of Dr. Smith, which I do from a warm appreciation of the paper, I would add a word upon the estimation in which such discourses are now held as compared with the prevalent opinion of them a generation ago. In the early part of the century, one could count on the tips of his fingers all the book-farmers in America. They were looked at with distrust

and talked of with contempt; but now the bulk of our food-producers are book-farmers. I hardly know a man of any repute in his county or any fame in his State as a model farmer, or even a good money-making manager of a country estate, who does not take the papers, (some of which are represented here every week), or read the current agricultural books. Who can speak of kinds or species, of staminate and pistillate—and the fruit-grower must know of these things if he knows his business—and not refer to such authors on botany as Professors Lindsay and Gray?

If he know how his crops grow has not Johnson helped him to such knowledge? If he speaks of breeds and species intelligently he owes something to Darwin. If he can manage a garden for profit he has learned to set his shoes in the foot-prints of Peter Henderson. Science is a closer attendant upon practical agriculture than many persons fancy.

Journals that devote much space to sound rural teaching count their subscribers by hundreds of thousands. The rank and file of our plowmen are desirous of being taught how far to plunge the steel beneath their surface and how to stir deeply without great cost, what lime will do, what profit there is in buying ashes or marl, or fish, or bone, or plaster. What is science but knowledge reduced to system and ticketed with suitable names—knowledge that can easily be talked about and readily understood? The possession of a single fact or truth, as for instance the circumstances under which the application of lime would be improper, may often save a farmer the worth of a good agricultural library, or the subscription price of a dozen rural journals.

Cattle Strangey Affected.

J. B. Thadaway, Chiltonville, Mass.—About two miles to the south of me is a farm on which it is not possible to keep a cow over two years without their becoming sick and useless, the first sign of which is shown by their hoofs growing to an incredible length; they soon lose appetite, pine away, and unless taken to some other locality, die. If taken away, they at once improve, and soon recover. There are other localities near the Cape where a similar trouble prevails on a neck of land near the Barnstable Marshes, where it is thought to be occasioned by the water drank. In this case, care has been taken to prevent the animals from drinking any water but that taken from a well or cistern. The remains of two that died were buried carefully

out of the way, and the cows changed to another barn, and yet they have just had to give up a cow with a calf three weeks old. What seems as strange as anything about it is the fact that a few years ago the farm used to keep one and two pairs of oxen and two cows, all of which appeared healthy, and were generally the fattest cattle about here.

Mr. S. E. Todd.—The difficulties are attributable to some local cause, or several causes combined. The long hoofs alluded to arise from frozen feet. Many sheep that are not properly protected during the cold weather have their feet frozen several times during the winter. The same is true of neat cattle. During the succeding summer the hoofs on those feet that have been frozen will frequently push out four to six inches beyond their usual length, and turn up like sleigh runners. I saw a large bull in the cattle market whose feet had been frozen so often that the animal could scarcely walk, as every hoof had pushed out to such an enormous length as to compel the animal to tread on the heels and fetlocks of every foot.

The other difficulties are plainly attributable to the continued influence of bad water, want of protection, and proper feed. Let the local difficulties be removed, and there will be no trouble in keeping any kind of animals in a thrifty condition. A great many people water their stock from well water that has been colored with poisonous drippings of the stable and barn yard. This cause alone would be sufficient to kill all the stock. A farmer in New Jersey lost most of his horses by giving them poisoned water from a well in their stable.

Putting all the Manure on the Grass.

Mr. Nathaniel Platt Herrick, Bradford county, Penn. — The remarks by the Hon. George Geddes, are good, and speak well for his knowledge of practical farming; yet, when to plow up the grass and where to apply the manure, does not appear so plain to that gentleman's writing. His conviction that grass is the foundation of all our farming is my conviction. That rotation of crops which will make a farm and its owner rich the soonest with the least labor, is precisely what I would like to discuss with Mr. Geddes, if I could talk with him. My land, like his, is adapted to all kinds of grain and to timothy grass and red clover. My practice is, when I sow a piece to grass, not to plow it again in less than eight years; and I frequently let it lay a much longer time. I have a meadow now which has been mowed for sixteen successive years, and it was never

better than now. In fact my meadows, under the right treatment, grow better as they grow older. I do it by *returning to a meadow all the manure the hay made that was taken from it*, and sowing a bushel of gypsum per acre each year. In that way the yield of grass is heavier and finer and richer as the sod thickens. I use manure only for top-dressing the meadows; in that way I get double price for it. It produces as much worth of grass as it would in grain, and also reproduces itself again in the turf. My turf, when ready for plowing under, is a solid body of grass roots, twelve inches deep or more, and so thick on the top that no soil can be seen. I consider one such turf, when turned under, equal to 160 tons of first-class barn-yard manure per acre.

Land so often plowed for grain, gives up to the grain all the bone, beef and tallow there is in it; consequently, the grass crop is so destitute of nutriment that farm stock will not thrive well upon it without grain a portion of the season. It furnishes a plenty of skin and rib, as the cattle are witnesses, but the flesh is minus. Grass grown upon land kept in the right kind of order for grass, will keep stock in first rate order at all seasons of the year. I have seen it tried in both ways, and know whereof I speak. Raising grain on a piece of ground, three seasons to two of grass enriches it in the same ratio that paying three dollars for two dollars would enrich a man. Like produces like in grass as in breeding—consequently manure made of good hay is the best for meadows. It stands to reason for meadows to grow better when their own production is honestly returned to them. Many of our writers on agriculture have incomes from other sources beside their farm, and can follow any system of rotation and have plenty of time and leisure. But the man who begins at the foot of the hill, runs in debt for two-thirds of his farm, all of his stock and tools, then clears his land of stone and stumps, walls it in, enriches it, and puts on the buildings, and raises a family of children, must sound all the depths of true economy; in that case he must not raise too much grain, if he does the sheriff will sell some of it for him.

Grape Vines from Leaves.

Mr. Joseph Harris, Moundsville, W. Va., enclosed a statement in these words: "Having made a visit to the propagating house of Messrs. J. and H. Harris, and upon examination of their grape vines, was shown some that had been grown from the leaves, with no wood or bark attached. The leaves being stripped from the vines

and placed in sand prepared for their growth, the bud and roots started out from the stem of the leaf. Having been heretofore skeptical on this subject, we are now fully convinced from our discoveries in the propagating house of the Messrs. Harris, that grape vines cannot only be grown from green wood cuttings but from simple leaves.

GEO. B. CURTIS,
R. B. CURTIS,
Propagators Anna Dale Nursery.

The Coming Fruit-Grower.

Mr. Marius Heighton, Franklin, Portage Co., Ohio.—I noticed in The Tribune of April 28, in your reports, a note from L. E. Reynolds of Mendon, Ill., about planting apple trees. It seems to me quite discouraging for a young man to think of digging holes three feet deep by three broad for apple trees, while it seems to me unnecessary. In the spring of 1868 I planted 117 apple trees in less than two days, and in a clover sod at that, and not one of them died. I mulched with rotted clover hay, and at this time I do not know of a more thrifty orchard. They made as much wood the first year as the trees in the nursery where I got them. In 1867 I plowed and planted the orchard to potatoes, and shall do the same this year. I tie them up with rye straw to keep the rabbits and woodchucks from gnawing them, which proves effectual. The soil is a sandy loam. I was only sixteen years old when I planted the trees, and run in debt for the land and the trees also. I have paid for it all now, by working my garden (one and one-third acres), planting it to melons, Hubbard squashes, and early Goodrich potatoes, working odd spells when father did not need me. Now, I think there are a great many farmers' boys who might do the same, provided they do not get discouraged. When I was fourteen, father gave me the use of a piece of land three rods wide by six and two-third rods long for one year, which I planted to musk-melons, and received sixty-five dollars for them, or at the rate of $520 per acre. The next year I bought my garden of one and one-third acres, and planted one-fourth of an acre to musk-melons, and received $150, or at the rate of $600 per acre. I think if farmers would give their sons a small piece of land to till for fruit or gardening, the proportion of men that leave the farm for other pursuits would not be so great as now. I would like to ask one question, viz.: What manures would the Club recommend for an orchard too far away to haul barn yard manure for a fertilizer?

Mr. J. B. Lyman.—If Ohio could turn out 2,000 or 3,000 such boys as this lad in Portage county, half the continent would in ten years be eating Ohio apples, drinking Ohio cider, boiling Ohio potatoes, and sending agricultural committees to study Ohio farming. We say to Marius, go on my lad, God bless you and your orchard! May the east wind never blast your buds, may the curculio never sting the red cheeks of your apples; may care and losses never blanch your own ruddy cheeks.

For that orchard that is to far for hauling from the barn, we will prescribe. You burn wood in Portage county, and mostly oak wood, some beech and maple. Now, you save every shovelfull of hard wood ashes, and buy all you can at a reasonble price, for that orchard. No matter if they are leached—they are not much hurt for manure by the leaching. Then, some wet day, get your father to give you the use of the steers, and plow up some rough piece of pasture land near the orchard, take the sods and pile them, and let them rot down. Go to the woods with side boards on the cart, late in the fall, just before Thanksgiving, and gather a good many loads of leaves, oak, and beech, and maple, preferring the beech, pile them in a wet fence corner, and throw some sods on to keep them down and help them rot. Early next spring you will be able to throw half a cart load, perhaps, of compost under and around each tree; that will prove for apples better than yard manure. You may know of some neglected piles of rotting oak tan bark, or oak sawdust. If you do, and the distance is not too great, let it finish rotting in your orchard.

The Destruction of our Pine Forests—The Remedy.

The following paper was now read by Mr. W. H. Trowbridge, of Michigan. He said:

The impartial and well-informed observer must view with alarm the wholesale destruction of the forests, no less than the reckless consumption of lumber. And it is notable that the very ones who are the heaviest engaged in this destruction are those who least comprehend it. The lumbermen of to-day, having sufficient for their present needs, are careless and blind as to the wants of to-morrow, and only those among them who have witnessed the almost total exhaustion of pine from the forests of Maine, or from the pineries of the Allegany region, can fully realize the enormous demand upon a comparatively limited supply. The Canadian forests will need no

mention, as they are hardly adequate to home consumption and the wants of England. Then from Michigan and portions of Northern Wisconsin and Minnesota must come all the pine for a vast area; an area, indeed, scarcely bounded by the Rocky Mountains and the Atlantic ocean. An inspection of the fleet and a tour through the lumber-yards of Chicago will astonish one not conversant with the magnitude and character of the territory to be supplied; and it is asserted that from Detroit alone(a smaller market) lumber has been shipped to twenty-nine different States in a single season. The demand from this section for the eastern and middle States has been rapidly increasing: and the rapidly settling and extensive prairie states alone will consume an amount scarcely to be estimated. It must not be supposed that the pine districts, so-called, are by any means all pine. The smaller trees, spruce, fir, tamarack, cedar, beech, maple, elm, ash, white birch, basswood, poplar, &c., constitute by far the greater portion of those districts. Nor is it generally known that lumbermen have already penetrated to the very headwaters of every considerable stream and its branches. We quote from the Detroit Post of April 16: "The lumber-camps on the Saginaw and Muskegon rivers, during the past winter, in some places were less than twenty miles apart." The one runs east and the other west, thus extending nearly across the entire peninsula, and the pineries are all in this manner penetrated by streams suitable for "driving" (or floating) logs. Yet, portable steam saw-mills, with their branching railroads, are facilitating the general havoc. The absence of woodland is seriously affecting many of our crops, especially the cereals, and it is alarming to notice the failure of the peach crop in New York, New Jersey, and even in portions of south-east Michigan, till recently well wooded. In the strong language of a friend, "Palestine, once a highly fertile and beautiful country, '*a land flowing with milk and honey*,' is, at this day, a mere brick-yard." Short-sighted cavillers against the Scriptures have used the barrenness of this country to disprove biblical accounts of its fertility. They ignore the fact that invaders first stripped it of its forest. Then the leaves, aptly called *nature's lungs*, no longer existed to preserve the rain and dews and to protect the vegetation from the scorching sun. A more modern illustration is in the Island of Madeira, which the Spanish navigators used to view with awe as they beheld it in the distance, ever shielded by a dense, overhanging cloud. Its characteristic name is due to that circumstance. Existing under a

tropical sun, this cloud was formed by the ascending vapors from the *then* densely wooded island. In destroying the forests, to make room for the further production of the grape, they "destroyed the goose that laid the golden egg." The celebrated Madeira wine has had its day, and it is asserted that not a grape is now grown on the island of Maderia. From an island of luxuriant fertility. It has degenerated into a comparative waste, and the "cloud" has long since vanished. Professor Kedzie, of the University of Michigan, and the lamented Rev. Frederick Starr, Jr., of St. Louis, have written scientific articles upon this subject, and the planting of trees has been suggested. But, as a pine log which has acquired a growth of one, or even two centuries, is by no means large, this plan, alone, will not solve the pine question. Many of the leading minds of the day have anticipated the coming scarcity ; and it may be mentioned that the Rev. Henry Ward Beecher and several of the "railroad kings," including Vanderbilt and Ogden, are said to have invested quite heavily in pine lands. Timber-land bought ten or fifteen years ago, at government rates, has been sold at from ten dollars, even to fifty dollars per acre. For well-selected land, even the latter figure is reasonable ; for a thousand feet in the tree would not be enough to cart it very far away, when sawed, in view of all the facts, timber-land must thus continue to advance, and in this lies the only protection. Our government does not watch these interests with the same care as is exercised by some of the European powers. Therefore, timely speculation is the only remedy against the wholesale destruction of the pine forests. Whole towns are constructed of pine; houses, barns, roads, pavements, sidewalks and fences. As the price of lumber enhances, a substitute will be adopted in the more durable stone, brick and iron. Then a large per centage of the logs now allowed to rot in the woods will be saved, consisting of large "butts" partially decayed, and of huge "tops," a little too knotty to be profitable, while good lumber is there so cheap. Then the reckless use of the circular saw, chewing one-third of the whole log into sawdust and the waste from thick slabs will be checked. The latter often contains as much material as the eastern saw-logs, specimens of which may be seen in booms on the Mohawk, the Susquehanna, or the Delaware rivers, which western lumbermen would compare to telegraph poles. But, without smiling, they should see in these diminutive "logs" a moral. It will be seen that the question is of vast importance, and one which merits the

attention of economists and statesmen. Acting in ignorance of the existing facts, there is no protection, in price or otherwise, and lumber is improvidently employed instead of stone or brick, until absolute want must inevitably result. We do not venture to suggest a complete remedy, but the first step is to become acquainted with the subject; then, as the scarcity increases, prices will advance, and tracts be reserved for future use. Brick, stone, iron, and their improvements, tubular and malleable iron, steel, and even artificial stone, cements, and newer developments of science, will be adopted; young forests will then be protected, and even new ones planted for the wants of the distant future.

Dr. J. V. C. Smith wanted to know how they could expect civilization unless they cleared away the forests. As to the loss of fertility spoken of in the Holy Land, he would say that there was no country in the world so productive as Palestine at the present day. He had been there, and he believed that the parable of our Savior was everything but poetry; the one which refers to the sower going out to sow his seed, and those seeds which fell upon good soil bringing forth a hundred fold; for he himself had seen the birds following the sower in numbers sufficient to eat every grain of seed up almost, and yet the crop turned out immense. In that country the barley and wheat crops were unprecedented, and so with other grains.

Mr. J. B. Lyman said that it was difficult to prevent a man buying what he liked to build his house of, but it certainly would be desirable that builders should not use the white pine of the country for their "big" timbers. Those timbers four by eight and four by three are mostly of white pine because it is convenient and light and because men like to work it, but for this "big" or "range" timber, twenty woods were just as good, and what he wanted to suggest was that men use maple, hemlock, chestnut, and the common kinds of oak and poplar instead of so precious and so rapidly decreasing a substance as white pine.

Adjourned.

June 8, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

HORSFORD'S YEAST POWDERS.

Mr. J. H. Tompkins, Grand Rapids, Michigan.—Professor Horsford of Cambridge, Mass., has invented a combination of an acid and an

alkali in bread, which he claims is not only harmless, but adds to bread, biscuit, and cake the valuable elements that are removed in bran by a fine bolting cloth. The acid is phosphoric, and is obtained by grinding bones, and extracting the acid from bone flour. But Mr. Tompkins, having tried the powder, does not like it, and wishes the Club to express its opinion, or to direct a scientific examination of the compound, so the very large portion of the reading community that look hither as to a friend, philosopher, and guide may not sit in darkness. The matter was referred to a committee consisting of Professor Whitney, J. B. Lyman, and Dr. William W. Sanger.

Deep vs. Shallow Plowing

Mr. David Pettit, Salem, Salem County, N. J., transmitted a lengthy epistle, which in substance is as follows: He first referred to a report of a committee of the Club which visited his county in the summer of '67 and '68, which sustained his idea that shallow plowing was as effectual as deep plowing. He thought that many of the discussions and letters received by the Club were wide of the question. He thinks the question of deep and shallow plowing is an important one, and if properly settled would be a great saving to the community of millions of dollars' worth of machinery and unnecessary labor. He wished to say that if the subsoil is richer in plant food than the soil, he had not a word to utter against deep plowing; but that it would make the soil richer. But if the subsoil is poorer in plant food than the soil, plowing deeper would only make the soil poorer. But where the subsoil is not richer in plant food, all other circumstances being equal, I hold the opinion that the soil can be improved with much less labor and expense, and be more productive and more humid, and be able to maintain that humidity and productiveness by plowing only five inches, and retaining all the vegetable matter in those five inches, than by plowing much deeper, subsoiling, &c. Where there are obstructions in the subsoil to the moisture rising from below in a dry time, it may be of advantage to subsoil, when it will pay. I have land in the outcropping of the middle green sand marl bed, which becomes so stiff in a dry time, after being pulverized like the stiff clay, that it is difficult to make a pitchfork stand alone by jabbing the tines in the ground, so compact that a rain of five inches has not wet the ground sufficiently for plowing. This land is easily pulverized, and is productive when moderately wet. We have other land here not sandy, but clayey,

of a fine texture, much too loose for young crops to start well in; and unless rolled after seeding, it becomes packed by rains or both; the young crop does not succeed well, as all lands are more or less of this nature, and need a certain degree of tenacity in the soil for the young plants to grow in after pulverization. I have had experience in improving poor lands, and raising them to a high state of cultivation and have made the increased crops at the same time pay up the expenses of their increase, therefor, apparently without cost, and by plowing only five inches. I have tried, in making these improvements, many experiments in deep plowing subsoiling in plaster, and fertilizers of various kinds, in plowing under grain crops; some proving of the highest value, particularly clover, and some less value, as oats and broom corn. I now propose to demonstrate to the unprejudiced mind that deep plowing, subsoiling, &c., are of doubtful utility *on all lands susceptible of deep cultivation.* In the stiff land spoken of, we plow and pulverize the soil after heavy rain for a year or two years; after the next heavy rain followed by dry weather, the soil becomes as hard as before, and this course may be followed for one hundred years or any length of time with the same result, provided there is the same amount of vegetable matter in the soil. If the soil which contains nearly all the vegetable matter cannot retain a state of pulverization in a dry time; or becomes so stiff that no plow with the best team can enter, much less plow it; can the subsoil of the composition, minus the vegetable matter, retain it? Vegetable matter being a good loosener of the soil and retainer of moisture, which nobody denies, it is evident that without this the subsoil, after a heavy rain, followed by dry weather, will become as hard as before, the very circumstances which formerly produced that stiffness; therefore, subsoiling such land for such a purpose would be useless. If the above are the true and inevitable results attendant on subsoiling very stiff land are they reasonably so in relation to other subsoils in proportion to the tenacity of the other subsoils until we reach a state in which the subsoil is sufficiently loose? This must be true; but we have no soils or subsoils so stiff but that when saturated with moisture the roots of our crops can penetrate them; and as they require a certain degree of tenacity in the soil to succeed well, our friend Greeley is in part right when he says plants need anchorage, but not a fine loose soil or subsoil of twelve to eighteen inches from the surface, where but few of the roots ever extend; not far from the genial warmth of the sun and

the refreshing effects of the dews and gentle rains, but near at hand where much of the larger portion of the roots do naturally concentrate and seek food and moisture, near the surface where they can find what they seek in the moderately compact soil. He, Mr. Greeley, varies on the principle that the roots can find these more certainly and abundantly there if they will depart from nature's line to find them. But the real question is, will they do this? If plant food is planted at a great depth below, where nature's laws designed the main body of the roots should go, and placed there at a great expense and much labor too, will the roots violate nature's laws so far as to seek the food there placed *to an extent to pay the extra expense of pulverizing the ground and placing it there?* That is the real question at issue. Until the advocates for deep plowing and deepening the soil can show this to be the case, their system must be an utter failure; and unless or until they can make it appear, which they have not attempted yet, that the material tendency of the main body of the roots of our field crops (not a few straggling ones) is downwards on the cold, sweet, subsoil far below, and away from the genial warmth of the sun, in connection with the reviving effects of the dews and gentle rains and moisture brought up from below by the heat of the sun to the surface before it can evaporate, their system must be a hopeless one. Our virgin soils are but rarely four inches in depth, much of them less, except where the wash of the country has deepened them, and these have received the accumulation of the roots and vegetation for many thousands of years, or since the surface of the earth received its present form. These virgin soils have become deepened only as the plows have gone down and mixed the root soils with them, and not by the roots of the plants penetrating and enriching the subsoil. I know land of the above description which has produced thirty-five bushels of wheat, and straw enough for much more, to the acre, 100 bushels of corn, and as much grass as could grow, the subsoil of which is loose for several feet from the surface; but the roots of the above crops, with many others, have never penetrated the subsoil in sufficient quantity to change its color or make it perceptible. This, to me, is conclusive evidence that the natural tendency of the roots is not below; and I apprehend all the inventions and contrivances of men will never be able to change the course of nature so as to drive or induce the roots to seek food and moisture below where nature or its great author designed them to."

Mr. A. S. Fuller.—I do not envy the position he has taken, for he is in direct opposition to every learned and practical man who has written upon agriculture since we have had any literature. Since John Johnston and Geddes, there is not one agricultural man living but has advocated deep plowing as a principle. Mr. Pettit can set himself up in opposition to these men if he chooses, but no one will envy him the position.

Dr. Isaac P. Trimble.—I have heard Mr. Geddes speak upon the subject of deep plowing; but he lives in a district of country where you may plow as deeply as you like, and still the soil is the same thing; it is a drift. Not only that, but he says it is necessary to put manure upon the ground. It is not one in a thousand farmers who are so situated in regard to their land. Here is Mr. Pettit, who says that he has brought up land from a poor state to the highest condition, and never plowed more than five inches. I will take anybody here, and go next week to farms down there where they do not plow five inches, and which produces double the amount of Mr. Geddes' or anybody else in New York. I will take a bet that I will show as many fields producing 100 bushels of corn to the acre, with shallow plowing, as he will show me fifty bushels to the acre with deep plowing; and shallow plowing is attended with so much less expense. I wish to warn farmers against the danger of throwing thin soil, on which they must depend, under the depth of subsoil which they do not want upon the surface. I hope the deep plower will examine this letter, and prove that it is correct. By all means let it go out, that the farmers can see the reasons of that plain, practical farmer's account, who lives in a region where you will see more than seventy fields of corn which average seventy and eighty bushels to the acre, and has shown over forty acres which average 100 bushels to the acre. That is far better than mere theories.

Mr. Steven P. Andrews said that he was not a farmer, but he might relate some facts which he heard from a farmer from South Carolina, who was a most intelligent gentleman. He said that several of his neighbors had been reading the northern journals advocating deep plowing, and they had sent up here to procure plows for deep plowing, and plowed their plantations, and the result was that they ruined their farms. The soil was light, and the change that it had produced, throwing up the subsoil upon the top of the light productive soil ruined several farms.

Mr. A. S. Fuller.—I advocate deep culture as a principle, not

locally, in any one county. I have seen land plowed only two inches deep that would beat Pettit's. If any one don't know better than to bury his soil where the roots of the grain cannot reach it, let him do it. But if I were going to plant trees, then I would put the soil down where the roots could get at it. I believe that for grain deep culture is the true principle. I know it; I have practiced farming and deep culture, and we gardeners do it about as thoroughly as anybody, and I never knew a farmer who went contrary to this principle succeed. I think common sense should teach a man.

Professor Whitney thought that there were two mistakes in the letter. The first was, that Salem county was a fair example of the land throughout the globe; and the second was, that the writer says that if we till deeply we must bring up the subsoil. In New Jersey I had occasion to examine the soil, and it is a soil which permits the roots to pass down to the subsoil, and it contains a very appreciable amount of organic matter which is derived from that source. We need not bring it to the surface; but if we pulverize it, it disintegrates the manurial constituents and allows the water to filter away, and catches the manurial matter, and it is a rule that all plants grow not in any particular direction, but go where the nutriment is found. Some sixty or seventy years ago, when the English dug up Major Andre, they found a peach tree that had its roots in the skull. The sole object of tillage is to get at the mineral properties of the soil, so that the roots can obtain their nutriment. There are lands where we can plow deep and invert. I know land upon which I myself worked which was plowed to the depth of ten or twelve inches, and, though the yield had been small before, yet we had a heavy crop of oats. In other lands again, the subsoil is too cold to bring to the surface, and then, of course, it is better to stir it merely, and let it stay below the surface soil. As to what Dr. Trimble says about Mr. Pettit regularly doubling Mr. Geddes on corn, I don't believe it. He says Mr. Pettit can raise 100 bushels as often as George Geddes does fifty to the acre. I will believe it when it is proved. We hear a great deal about big crops of corn, but I know a farmer, admitted to be the best in a county near Salem, and where the land is similar in all respects, and he says it is good cropping when, taking one year with another, any twenty acres give 2,000 bushels of ears. Again in wheat, which is a test crop, I would like to know of Mr. Pettit if his crop averages the rise of twenty-six bushels to the acre year by year, or if any ten farmers in Mannington township will say that

their wheat crops average twenty-six bushels per acre one year with another. In the neighborhood where Mr. Geddes lives this is the average crop.

CAN FARMERS RECOGNIZE THE TEN HOUR RULE?

Mr. George F. Powell, Ghent, Columbia county, New York, writes: "There is one question which I desire to present to the Farmers' Club for its consideration. *The ten hour system of labor. Can farmers employ that system in carrying on their operations successfully?* Day laborers upon the farm are now working upon that system, and expect to do so through the harvest season. Can the immense harvests of the country be secured working only ten hours a day, while with all of the machinery we have at present for expediting business we can hardly get large crops of hay and grain gathered before they are injured from long standing? Can the myriads of weeds that beset all cultivated crops from early spring until autumn be successfully subdued upon ten hours a day? If that is to become the universal system, or, as the government has established eight hours, can farmers afford to pay in addition to the present high wages, for the extra hours of labor which must be performed? Many laborers are leaving the farm and going upon the railroad, into the trades, &c., and farmers are combining not to hire any laborers upon that system. Much difficulty is likely to arise from this cause, and the interests of agriculture to be seriously affected until some basis can be amicably agreed upon. I desire to see the laboring man given all the privileges that are calculated to advance his interest, that he may rise rather than be crushed down by oppression. At the request of many intelligent farmers I submit this labor question to the club, and ask that it may receive its candid consideration, and that its conclusion may be put in print as early as possible."

Mr. A. S. Fuller thought that the whole thing would regulate itself.

Dr. Isaac P. Trimble said that the farmer was very differently situated from the mechanic. Many mechanics work under cover and they can work a certain number of hours, but a good deal of time is lost on the farm on account of the weather, and especially so in harvest. I should feel very indignant if the men working for me in harvest-time should stop work at the conclusion of the eight hours, for instance, when I was preparing a crop of hay to take in and

when there was time enough to house it then, but a rain was threatened next day. Why, the whole crop might be lost in that way. I cannot think that it will be profitable for this system to obtain between the laborers and the farmers. If the former insist upon it, why then the farmers must go to work and increase their machinery so that they can do without that labor that would stop at the end of eight or ten hours and let the crop be lost. I do not think that we should advocate its being applied to farmers at all. It would increase the price of food if we should reduce the hours of labor.

Mr. A. S. Fuller.—Ought we to meddle with the thing at all?

Dr. Isaac P. Trimble.—I don't think so. The farmers are able to take care of themselves. If we find that the field hands will not work more than eight hours, then we must go to machinery.

Mr. Thomas Cavanagh.—I think the gentleman is a little old-fashioned. It seems to me that the farmers, when they pay eight or ten dollars a month, think that they do not get enough of work out of the men. On Long Island I remember the farmers used to have the men out at four o'clock in the morning, and worked them till after dark at night; but that time has passed away. If a man is hired for ten hours, he has the right to stop when those ten hours are expired. The best way is to hire monthly men.

Mr. J. W. Gregory.—When I was young I was bound by the year, and my employer believed that he owned me, body and soul.

Mr. Aaron M. Powell (Brooklyn).—No one who has observed at all can fail to see that the question is a great problem. There must be evidently, upon the part of the working classes, some standard. It will not do to have them an exceptional class of workers. In manufactories, and such like, there is a standard which the national government has adopted. The men require to resolve that they will not go through harvest. When the president allies himself with the eight-hour movement he affects society from one end of the country to the other, and it must be met. Senator Sprague sees, looking ahead like a shrewd statesman, that the labor movement is to be in the hands of the politician; and when it does get in that attitude, then it becomes a very important question to farmers. They will have it thrust upon them, and I think it is well that they should have it thrust upon them. The young men know that in the farm life there is not the poetry that is spoken of; and it is because we have ignorant men who have consented so long to be classed as an exceptional class that

has made it so. I am glad that the workers on the farm are coming to the point to demand a standard of labor. The owner, if he is a grasping man, grinds his men almost to death. The man, if he be a shiftless, tricky sort of a person, will take every advantage. It would be well, therefore, for both to have a fixed standard for the hours of labor; and if the work is longer than the stipulated time, let the compensation be proportionately increased.

Mr. N. C. Meeker thought that the country was dying for a decent Christianity. [Applause.] When the farmer treats his laborer in the way he would have his son treated, then we will have good laborers. The workingmen are humbugged and swindled.

Dr. Lozier thought that the Farmers' Club should place its opinion as to this matter upon record. Christianity was not at fault; for Christianity does not teach such oppression. Christianity reaches out its hand to all alike. It was important that the control of the question be established by public opinion. If there was one thing more than another for the Club to do, it was to place itself right in the matter. It will regulate itself through outside pressure, as other matters of social reform are regulated. We ought to go directly to the subject, and advise the farmers to pay a fair rate of wages for a fair day's work; and if more is done, then they shall have an extra wage for it. The farming people should establish some fixed rate of wages, and insist upon it; and if the farmers pay more for raising their products, let them be remunerated. It should be the gospel of this Club to introduce labor-saving machinery, and pay the necessary amount to the laborer.

Prof. Whitney.—There is no class of men which is paid better for what they do, or are treated more honorably, than the laboring class on the farm. The farm laborer stands higher than the mechanic. If he is worth anything, and has integrity, honesty, and brains, he will soon be able to get a farm for himself. But farm labor is a question with which we have nothing to do. The farmers have brains enough to settle it for themselves. I believe that if the question of eight hours or ten hours were put to the farming community there is not a class of men engaged on the farm but who would vote it down at once; for they know that if they establish a system to-day that put a dollar more into their pockets, the same system would take it out of their pockets to-morrow. Our opinion, should we put it upon record, would be received with ridicule throughout the country. We had better follow the good old thirteenth commandment, and "mind our own business."

Mr. Aaron M. Powell.—I do not agree with the gentleman that we have nothing to do with this question. If we shut our eyes to it, so much the worse for us. The time has come when those who discuss agricultural affairs in this country should make up their minds that the laborers should not constitute an exceptional class. I know what agricultural life is. If it is so good, why is it that so many young men are deserting the farms? Why is it that agricultural labor is dreaded? Why is it that the cities are being filled up so rapidly? If you fix a standard of labor for the farm, and give the laborers their hours of leisure; if you improve the condition of the working classes, and educate their children; if you will fix a limit to their toil, it will be such a gain to the farming community that it will make farm labor creditable and honorable, which it is not now in the sight of other laborers.

Prof. Jas. A. Whitney.—I hope this Club will not turn aside from the discussion of strictly rural topics to theorizing on human rights, or attempts to regulate labor. Some things have been said here which, if reported strictly, would make us laughed at. It is fortunate that some of the gentlemen who stand between us and a great public act in the spirit of the old couplet about charity at home:

"Be to her faults a little blind:
Be to her virtues very kind."

I move that the question of hours in farm labor be laid over indefinitely. [This motion was seconded by Mr. Lyman, and carried.]

American Opium.

The address of the gentleman, who made some remarks recently in relation to the raising of poppies and the manufacture of opium, is W. C. Wilson, Monkton Bridge, Vt.

How Should Tea be Made?

Mr. J. T. Ogden, Sidney, N. Y.—The people of the United States annually pay $20,000,000, more or less, for the single article of tea. Probably nine-tenths, if not ninety-nine hundredths, of the housewives and cooks, in preparing this beverage, boil the tea from three to ten minutes. But the chemist tells us that tea boiled is ruined; the essential principle, theine, being dissipated. Therefore the people of the United States pay some $20,000,000 annually for the privilege of drinking tannin and other injurious extractive matters, while the tea, or theine, which alone is of any value, is utterly wasted. Twenty

million dollars paid for China tannin, which is probably no better than that which could be obtained from our own hemlocks and sumacs at a tithe of that sum. So much for the theory. Who can give us the facts? It is not enough to say that tea should not be boiled. We want the facts and the figures. Let some chemist perform some experiments like the following: Steep (not boil) a given amount of tea in a certain quantity of hot water five minutes, and then analyze both the water and the dregs, to ascertain how much of the theine has been dissolved, and how much remains in the leaves. Next, boil the same amount of tea in the same quantity of water, and then analyze both the water and the leaves, to find how much of the theine is saved or wasted. It is time that this subject be investigated, and the facts laid before the people. It is not enough to tell our wives and cooks that tea should not be boiled; we want the why and the wherefore expressed in definite forms and figures, and signed by competent authority. Who will give them?

Prof. James A. Whitney.—There is no necessity for making the analysis suggested by the correspondent, because the whole ground has been gone over by chemists already. The quantity of theine or coffeine varies in different kinds of teas from two and one-fifth per cent of their weight to four per cent. In some very rare cases as high as six per cent. The average is probably not more than two per cent; some of the adulterated containing less, while the better qualities have more. By a simple process the theine may be separated from the tea-leaves in the form of minute crystals with no odor and with only a slight bitter taste It is the substance which produces the exhilarating effect when the tea is drank, but it has little or nothing to do with the taste and flavor. These are derived from the tannin, of which some kinds have upward of twenty-five per cent; from the aromatic oil, which amounts to about three-fourths of one per cent, and perhaps in a small degree from the gummy matter, of which there is commonly in the neighborhood of fifteen per cent. It is thought by some, Prof. Johnstone among others, that the tannin has also something to do with the effect of the tea upon the nervous system. When we simply *infuse* the tea, that is, pour boiling water over it and and remove the tea-pot to the table, we extract the theine, which is the really valuable portion, together with enough of the other substances to give it a mild and pleasant flavor. By boiling we extract more tannin, and make the liquid darker in color and more astringent in taste, but little or no better as a healthful and

cheering beverage. When taken as a medicine, as for instance to cure a nervous headache, it should be made strong. Very strong tea is an antidote for poisoning with opium and also with tartar emetic. In these cases the tea should be boiled for the reason that it is the tannin and not the theine which forms the antidote to the poison.

Canning Corn.

Mrs. Wm. B. Hazleton, Mahopao Falls.—I will give my experience how to do it, which does not fail with me. I take the sweet or even green corn before it gets too old, cut it from the cob, fill my cans full, pressed down. I then take a boiler, lay some sticks in the bottom for my cans to set on, I then lay the covers of the cans on, fill the boiler with water so that it will cover half-way up the sides of the cans, put the cover on the boiler, boil for three hours briskly, take out and press the covers on tight. Will keep well and have all the flavor of green corn.

Chickens.

Mrs. Lydia B. Read, Eagleswood, Perth Amboy, N. J.—Last year I raised over 100 chickens, having fourteen old stock. Three hens did all the nursing, one Brahma taking care of forty-five chicks, and brooding them well until the oldest were able to go to roost on a perch close by. Of two broods I lost none by disease, but three by accident. The other was placed under a tree, and a violent rain coming on while the chickens were very young, several became blind and died. I never have a case of gapes, for I feed only with cracked corn, wet slightly with boiling water. This I believe to be a sure preventative. This spring I wished to raise 200 or more and am trying the experiment of bringing them up without the aid of the hen, allowing her the freedom of the yard after bringing the chickens out of the shell. My first brood was hatched the 15th of March, and have grown finely. I use houses with glass roofs, warm and tight. For a brooder I use a sheepskin, or its equivalent, tacked with wool side down, on a frame inclining a little, so that several sizes are accommodated.

Lozier's Hay Loader.

Dr. Lozier exhibited his improved hay loader; it is easily attached to any wagon; it has a crane with a hay fork fastened to it; pins are driven into the spokes of one of the wheels forming a reel on which the rope that pulls up the fork is wound; it costs about fifty-five dollars and will be found to be an admirable instrument.

MONROE'S ROTARY HARROW.

The following gentlemen were appointed a committee to examine Monroe's rotary harrow in operation:

Messrs. J. B. Lyman, S. E. Todd, Dr. Hexamer and Wm. S. Carpenter.

Adjourned.

June 15, 1869.

Mr. NATHAN C. ELY, in the chair; Mr. JOHN W. CHAMBERS, Secretary.

COST OF A CHEESE FACTORY.

Mr. E. F. Partridge, Morristown, N. J., asks the Club to inform him what would be the cost of establishing a cheese factory.

Mr. J. B. Lyman.—A good factory may be erected and equipped for about $2,500; but before going into the business our correspondent should consider many questions. Let him correspond with Gardner C. Weeks, of Syracuse, the secretary of the American Dairymen's Association.

Dr. Isaac P. Trimble.—Mr. Partridge is too close to Philadelphia to think of cheese factories. He can make larger profits helping to supply that city with milk and butter.

BOTS IN HORSES.

Mr. James Little, of Sing Sing, N. Y., gave an account of a fine steed of his which succumbed to an attack of these destroyers, and he solicited information as to a remedy.

Dr. Isaac P. Trimble.—Bots are curiosities of natural history. The eggs which produce them are deposited on the knee joint of the fore leg, just where the horse can easiest reach them with his tongue. Here they hatch and produce an irritation, and the horse licks them off, and thus they are taken into the stomach. They are furnished with a kind of hook, with which they hold fast, and they feed on such nutriment as the food of the animal affords. If such nutriment is not furnished as is agreeable to their taste, or if their stomach is allowed to remain empty, they feed upon it, and thus cause the horse to perish. Of course, the stomach should be kept well filled. As to the various remedies prescribed, a scientific veterinarian would not meddle with them; and the treatment of certain persons, who call themselves horse doctors, is simply barbarous.

Mr. Wm. S. Lawton.—I am happy to say that I am proud to stand

in this matter on the side of the gentleman who just addressed us. His last remark, particularly, must come home to the good sense of most observers.

Prof. J. A. Whitney.—A cure is very difficult, but not impossible. Bots are quick in their attack. Their victim has symptoms like colic, and is likely to be dispatched in short meter. There are two remedies, well known and worth trying, provided you are in a hurry about it, namely, milk and molasses; and, second, a strong decoction of white oak bark. However, it is best to use the ounce of prevention. If you feed a horse four or five quarts of potatoes twice or three times a week, he will be kept out of danger. Experiments show that the pulp of raw potato kills the bot worm; hence, a good feed of this tuber is often a cure, always a preventive.

Mr. A. S. Fuller.—It is well to go to the prime conditions. Keep the animal clean. Wash his fore legs frequently, and thus dislodge the enemy before he is taken into the stomach.

COUNTRY SEAT OF WM. S. CARPENTER.

Mr. S. E. Todd.—Our member, Mr. Carpenter, has been reproached as a "sidewalk farmer." A short time since I visited his place, and take great pleasure in saying that Mr. Carpenter's farm is located in Westchester county, some thirty miles from the metropolis. It embraces about thirty acres. The surface was originally rough and rocky, but the soil was good, and capable of producing any kind of fruit and field crops. Mr. Carpenter spends much of his time here in this city; but he is on his farm often enough to supervise and give personal attention to the numerous things that require timely care; and few matters can be said to have been neglected. He has expended a great amount of money in procuring almost an endless variety of fruits, farm implements of the latest inventions, fowls, and other animals of the choicest and most approved breeds. He has now growing the largest number of foreign and rare trees that I have ever met with on the grounds of any private citizen. The weeping beech, the weeping larch, and a large number of rare and curious trees have been procured from Europe, at a great expense of care and money, besides rhododendrons almost innumerable. On his grounds there are over a thousand thrifty pear trees, all of the choicest varieties, and every kind of apple tree, the fruit of which is worth cultivating. And, what is remarkable, this sidewalk farmer has the name of every kind of fruit and tree at his tongue's end. It is never

necessary for him to call the gardener to inquire about this or that, in any department. The country is indebted not a little to the efforts of Mr. Carpenter in developing and improving pears, apples, and the small fruits. The wind had so damaged an old denizen of his apple orchard that the stub was cut down and removed; the stump, which was as high as my hand, was measured, and the diameter was four and a half feet. This old apple tree was in full bearing when the wind broke it down; and near by stood an apple tree from which Mr. C. plucked twenty-one barrels of good apples! What a commentary those facts present against the absurd theory that varieties deteriorate and run out. One of the most attractive features on the farm is the beautiful evergreen hedges which had been planted some three or four years. Ornamental hedges of the arbor vitæ have frequently been made, besides those on his place. Indeed, this kind of hedge is very common all over the country. But it is a rare thing that we meet with a hedge of Norway spruce, which is so perfect in every desirable form, as the beautiful hedges that may be seen on Mr. Carpenter's farm. It would be exceedingly difficult for even a chattering wren to find a passage through it. The fact shows most conclusively what may be accomplished in the construction of hedges, if one understands how to manage the growing plants.

Mr. Carpenter spares no money nor effort to procure a specimen of the best of everything that the country affords. If a new implement is manufactured, he understands the requirements of every agricultural tool and machine so well, that many manufacturers often rely more on his judgment as to its merits than on anything else. If a laborer does not understand how to handle any hand tool or field implement, the proprietor of the farm can show him.

It was a great pleasure to see all the arrangements about his outbuildings. Few farmers can show a more satisfactory poultry department. Most of his fowls are of the Asiatic Bramah breed, numbering, I should think, nearly 100. We were shown, also, a beautiful trio of dark Bramahs, which had been imported at a great expense. These are great layers. Besides these varieties, we were shown several fine Houdans, spangled Hamburghs, &c. Mr. C. feeds all his fowls in the true and philosophic way, by keeping feed of several kinds constantly before them. This is the great secret of success with fowls of any kind. I must pass by many objects of interest, such as ducks, and pigs, and other domestic animals. The arrange-

ments in the stables are well worthy of a passing notice. The stalls are spacious, the ventilation good, with a spacious feed room in front of the manger, having a firm cement floor. Into this room a stream of cool water is conducted from the hills, and also into the open yard. Behind the horses is a water-tight gutter, which conveys all the liquid manure to a large reservoir in the garden. The fine plants of all kinds assured us that no plant-food is lost. Everything is under cover. On opening a door in a small apartment there was a row of hens, each sitting in a separate box, where no other fowls could molest them. They are not allowed to go out of doors during the period of incubation. Consequently, no hen is in danger of being broken up when she is sitting on eggs that cost many dollars per dozen. I was told of one farmer in that vicinity who actually sold a number of eggs at twenty-two dollars per dozen.

Mr. A. S. Fuller.—I would like to inquire how much income Mr. Carpenter returns from his farm, and where he made the money. This is a subject that comes back to us practical cultivators. This story to which we have listened is all very fine, but pray favor us with figures.

The Chairman.—As for myself I must confess I have never been able to raise a bushel of potatoes at a cost less than double the market rates, but I judge Mr. Carpenter's experience has been different.

Dr. Isaac P. Trimble.—I have been an attendant of this Club, off and on, for a good many years, and I have never ceased to listen respectfully to the voluminous praises of Westchester county. And now we have just had another ration. I think the subject ought to be investigated, and I would like to be one of a committee of fifty to make a foray and find out.

Potatoes from Mississippi.

Judge Burwell sent a few tubers, grown in Vicksburgh, Miss., on and near the old earthworks and battle-grounds of the memorable siege. They were mostly planted by negroes, about the 20th of February. Specimens were handed to Messrs. Todd, Lyman, Crandell, Whitney and others, who had them boiled for breakfast next morning, and pronounce them equal, in table qualities, to the best northern potatoes. This shows that New York and other northern cities will soon have their potato supply in June and a part of July from the war wasted fields of the far south. They were of large size and fine appearance, and of the pink-eye and Russell varieties.

Mr. J. W. Gregory said he had experimented with potatoes in the

south, and found that the common western red was earlier and better than the popular peach-blow.

REPORT ON MONROE'S ROTARY HARROW.

A committee, consisting of J. B. Lyman, S. E. Todd, and W. S. Carpenter, appointed last week to examine and test this implement, submitted the following report:

"We went to the farm of Mr. Davis, near White Plains, and there met Mr. Monroe, the inventor. We saw a device resembling a large cartwheel laid horizontally. The spokes are ten in number, made of white oak, three by three, and each armed with three harrow teeth. The hub, or axle, into which they fit is a single casting, and through the center runs a strong kingbolt, to which a bar is attached. On one end of the bar is a small wheel running around on a narrow iron track near the outer ends of the tooth spokes; at the other end is the clevis. In addition to this is a cast-iron wheel of twenty-five pounds weight so connected with the kingbolt as to revolve near the out edge at right angles with the clevis beam. The effect of this wheel is to weight one side of the harrow, producing greater resistance, as the teeth thus weighted sink deeper. This unequal bearing on the two sides of the wheel-harrow give a rotating motion, combined with the forward motion, without loss of power. A sliding weight is so adjusted as to increase or lessen the bearing of this wheel at pleasure. The test to which we subjected the invention was severe. The field was a roughly turned sod, with grass sprouting high from the edge of each furrow-slice. There were some bushes, some loose stones, some fast stones, while a copious rain falling all the morning made the surface muddy where not grassy. A careful observation of the style in which this tool did its work has convinced your committee. 1 That, by giving the plowmen of America such a help for fine tillage as they have in this rotating harrow, Mr. Monroe deserves the thanks of farm laborers and farm horses. 2. We think his harrow going once over a surface will accomplish as much as any other harrow going three times over. As the direction of the rotation is easily controlled, it can, in harrowing, move always from the back to the upper edge of the furrow slice. No sod need be upturned by its action. 4. The rotating motion allows the implement to clear itself of clay, and free itself from a stump or fast rock. No lifting is called for, and the draught is uniform upon the team. 5. The teeth wear out alike. 6.

The tool does not operate as well with the slow movement of oxen. 7. The inventor acts wisely in selling the castings for a small sum, and not requiring every purchaser to take a complete harrow or nothing. With the castings and a set of harrow-teeth, any farmer expert enough to shape a good plough-handle can get out the timber and frame this harrow in his workshop. 8. Your committee specially commend to the attention of farmers any implement the use of which will make the mixing of soils and fineness of tilth easy and cheap. Few fields are as thoroughly prepared for grain crops as they should be. By the use of this and similar improvements in tillage the crops of the country might be greatly increased."

Large Poultry Yards.

Mr. W. E. Clarke wrote as follows: May not the failure of the numerous experiments of keeping large numbers of hens have been rather from lack of knowledge of their habits and wants and a proper attention to them than from any inherent difficulty? It seems to me that the success of one such practical experiment as Mr. Warren Leland's ought to outweigh twenty such as that related by Dr. J. V. C. Smith, which "presently began to look shabby, then fell sick and drooped, ate each other's eggs, pulled out each other's feathers, then died by dozens." Now may not *all* of this have been caused by want of proper food. Eggs and feathers contain much sulphur, and as these hens were fed on "chicken dough," containing little or none of that element, they were compelled to resort to the eggs and feathers of each other for a supply. Mr. Leland feeds largely with meat, probably a large proportion of which is animal livers, furnishing a full supply of sulphur and albumen, hence his success. I have kept hens in a small way, say from a dozen to forty, and have always aimed to give them such food as would furnish them with the material to build up and clothe their bodies, keep up combustion, and aid them in the manufacture of eggs. I have, therefore, given them grain, meat, including the livers of animals, chopped bones, and when confined, chopped turnips and cabbage; and when I have found them infested with vermin, I have done for them thoroughly what nature prompts them to do for themselves, but which they can do but very imperfectly, viz., dust them, and have always had good success. Sometimes, little chickens suffer greatly, and are denuded of their feathers, and die before they have learned to dust themselves. They should be thoroughly dusted two or three times and oiled about the

head and under the wings, &c. I suppose most gardeners learn from sad experience the fondness of fowls for the top of the sweet turnip and cabbage. I suggest, where large numbers are kept, that these should be sown for pasture for them, to which they can have access after they have obtained a sufficient start.

EXHIBITION OF STRAWBERRIES.

There was a fine exhibition of several varieties of this favorite fruit. Mr. Spencer Springfield, of Unionport, N. Y., sent handsome specimens of Seth Boydens, "No 30" large and excellent in appearance, and said to be especially productive. Mr. E. Williams, of Montclair, N. J., displayed the following sorts, and gave some interesting notes of each: "Downer's prolific"—On my place this grows in stiff loam. I regard it as the best early variety I have ever tested. It is rather soft for long carriage, but it is earlier, full as productive, a better grower, and of better quality than the Wilson, and keeps better. Though an acid berry, it has more saccharine and strawberry flavor than the Wilson, and though early it holds on as late as others. "Stringer's seedling" is a Philadelphia variety which does not sustain its home reputation. It yields a medium crop of good sized berries of fair quality. "Barnes' mammoth" is a good grower and promises well. The fruit is large and handsome. "Jucunda Knox's 700," does not grow as well as might be desired; but it yields some very attractive berries of prodigious size. In point of quality and productiveness, it is a great improvement on the Triomphe de Grande. "Charles Downing," is a seedling of Downer's prolific, by J. S. Downer, of Kentucky, is a very promising variety, and gives me more satisfaction than any new variety I have ever tried. It is a good grower, and produces a fine crop of large, handsome berries, very uniform in size. There are those of higher flavor, but this seems to possess such qualities as must make it very popular.

HOW SEEDLING STRAWBERRIES ARE GROWN.

Mr. A. S. Fuller.—Take one of these fine berries, mash it to a pulp, and mix sand with it. Sow in a box or bed of sandy loam, and water frequently. Soon little plants will appear; when they are as big as a dollar remove to their permanent bed. The first year they may bear a little; the second year one can judge very well of the quality and amount of the fruit they will yield. Some may be better than the variety you sowed, but most seedlings are worse.

Seth Boyden and his Strawberries.

Mr. D. B. Bruen.—While the taste of this delicious fruit lingers in our mouths I would say a word in praise of the orignator of the largest of these berries, Mr. Seth Boyden, of Newark. He is an old man, as I am and we cannot have many more years alloted to us in which to study nature and revere the God who made us in the works of his fingers. He is old, and the years of a long life have been devoted to diligent study of every art and every method by which the dominion of man over nature may be extended, and all matter brought to subserve human uses and promote human comfort. No one man in New Jersey has done as much as Seth Boyden to develop the useful arts by which the great manufacturers of Newark have grown rich. He made many improvements in the steam engine. Patent leather is, in an important sense, an invention of his. Of late his genius has been exercised upon problems in horticulture, and he has done more than any other man to perfect the strawberry. He studies the plant, observes and experiments, combining size with high flavor, and uniting shape, taste, and color in one berry. Could he live and push these discoveries, he thinks he might give the world a far better and much larger berry than any here to-day. The bigness of an egg he does not by any means regard as the limit of development in the strawberry. This noble old man is by no means rich, yet so free is he of false wants, so independent in spirit, that neither his city and State, nor this Institute, could present any substantial mark of their esteem which he could be induced to accept. A heart free of guile, a spirit above envy, and a soul made light by a springing interest in God's choicest works, these are his ample fund, his unfailing annuity.

Advice to Persons Emigrating to Iowa.

Mr. R. B. Groff, Marengo, Iowa.—Don't buy a farm the first year you come to Iowa, unless you have an abundance of means, say $3,000, after you have paid for all your horses and farming implements. Rent a farm of about 150 acres; it can be had for about as many dollars, cash, paid in advance. Sow about twenty-five acres in oats, and the same number in Hungarian grass. On the remaining 100 acres plant the best variety of corn. Two span of horses will cost less west than east. That will be enough power for cultivation. The most improved farming implements of all kinds can be had as cheap west as east.

Now, buy about fifty four year old steers; these can be had here now for about fifty dollars per head; that will cost $2,500; for the remaining $500 buy 100 head of hogs; these can be had for five cents per pound. Now for the profits of Iowa farming. I do hope all will examine these figures, for they are trustworthy.

You will have 5,000 bushels of corn, 1,000 bushels of oats, and fifty tons of Hungarian grass; it oftener exceeds this than under it, one year with another. Set the oats to be thrashed, and the straw secured by a good straw-carrier, and completely stacked in the shape of an L, to protect the stock from the chilling winds of winter, and they will do first rate. With the addition of the necessary corn 200 pounds can be easily stacked on each bullock, making 1,200 pounds. This, at seven cents per pound, the price it now commands in market, making eighty-four dollars for each bullock and each steer while he is fattening, will fatten two hogs by having them immediately follow the cattle. The hogs can thus be made to weigh 250 pounds, making 2,500 pounds of pork. Now let us sum up the matter:

Dr.		
Original cost of cattle at $50 per head	$2,500	
Cost of 100 hogs at 5 cents per pound	500	
Rent of the land	150	
		$3,150
Cr.		
50 head of cattle at $84	$4,200	
100 head of hogs, 250 pounds each, at 7 cents	1,750	
25 tons of millet, at $5 per tun	125	
1,000 bushels of oats, at 30 cents	300	
		6,375
		$3,225

Making over fifty per cent for every dollar invested, and this paid in greenbacks at your own door, by the drovers scouring the country to buy stock. Now show me the eastern farm that can beat these actual figures.

There is nothing in hogs and sheep alone. The former eat too much corn, the latter too much hay. It is hard work to raise these, especially the latter. But cattle will get shaking fat on these boundless meadows or prairies by the addition of a little salt during the summer and fall; will winter on oat straw, and by the aid of fifty bushels of corn to each bullock, and half a tun of millet, will be in splendid market condition by the first of March.

Moderation in Estimates.

Mr. B. Summers, Vermillion, Erie Co., Ohio.—Being an outside member of the Club, I wish to criticise some estimates made by your correspondents from abroad.

Mr. R. B. Groff, of Iowa, estimating profits of farming, reckons:

Dr.

Rent of 150 acres	$150 00
50 steers	2,500 00
100 hogs	500 00
	$3,150 00

Cr.

50 steers for market	$4,200 00
100 hogs	1,750 00
25 tons millet	125 00
1,000 bushels oats	300 00
Profit	$3,225 00

Now, admitting his figures and facts, is not this a fallacious showing?

My father pioneered in this county, and one of his rules in measuring rail cuts was to allow two inches at the sixth measure so as to be sure "*all the rails would be long enough.*" They surely were long enough, but I could never make out they were nearer of one length than if measured without the allowance. Neither can I see what is gained by making such loose estimates as this of Mr. Groff; the two and six inch margin would be better. The truth may be so colored as to mislead equally with a falsehood. Now, I submit, would it not be getting nearer the whole truth to say that the following should be added to the debit side:

Interest on, say $4,000 invested, including teams, tools, stock, &c	$400 00
Labor, and wear and tear, and seed to cultivate 150 acres	1,500 00
Salt, care of stock, &c	300 00
Losses by sickness and death,	400 00
	$2,600 00
This deducted from $3,225, leaves	$625 00

All the renter and his family does of the work is of course theirs by right, but is not profit, as they could have earned elsewhere as

well. And five poor men could run such a business without the aid of several hired men.

SOME NOTES OF A JOURNEY SOUTH.

Dr. J. E. Snodgrass, who had been on a trip to the Potomac border, observing the lands and prospects for emigration—particularly with reference to fruit lands, by way of becoming eyes and ears to his associates of the Fruit Growers' Club—was called on by the chairman to state the result of his observations. In responding, Dr. Snodgrass gave much valuable information. He said he would advise those seeking fruit-farms, or smaller bodies of land, as "small-fisted farmers" are supposed to do, not to go further south, at present, than Maryland or Virginia, or North Carolina at the farthest. On the line of the Orange and Alexandria railroad, in Virginia, and of the Loudon and Hampshire road in the same State, which runs about forty or fifty miles near the Potomac, he found lands admirably adapted to fruits generally—much of it, grapes particularly, being of what the people call the "rotten-rock soil"—which can be obtained for as small a price as twenty dollars an acre, and yet near Washington, which is no longer a village, but a growing city of 100,000 inhabitants, including its suburbs, and affords one of the best home markets in the country, and where there are good neighborhoods and good society.

PLASTER OVER CLOVER.

Mr. Miles Waterman, Franklin Township, Indiana, wrote to inquire if plaster sowed on clover after the first crop is removed, will benefit the second crop.

Mr. S. E. Todd.—Yes, if the plaster will be advantageous at all on the land in question.

DRAIN TILE.

The same correspondent asked how deep should tile be put down in a field that has a clayey loam top-soil and a rather hard and tenacious subsoil.

Mr. S. E. Todd.—He should reach the water, generally two and a half feet will answer; but sometimes it is necessary to go down a foot and a half or two feet further.

INSECT EXTERMINATORS.

Mr. I. I. Higgins, of Montreal, Canada, forwarded the following as the most effective remedy against a majority of the insects which

infest our gardens: Mix in three or four gallons of warm water one pound black or white hellebore, which costs about thirty cents here, and add to this, say eight or ten pails of water. Apply to the infected trees, bushes, or vines in any way you please, but a syringe is the best. The cure will be immediate and certain. I have tried it on the apple-tree worm, gooseberry and currant worm, and it kills them at once, as also the rose louse.

Mr. A. S. Fuller.—This same recipe, or a similar one, appears in the old Cottage Gardener's Dictionary, published in England forty odd years age. Nevertheless, the remedy is none the worse for that.

Mr. J. G. Gibbard, of Western New York, said he had used pulverized shale as a substitute for plaster, and that applied to gooseberry bushes it destroyed all insect pests with which they might be infested. He also stated that forty townsmen of his had had similar experience, and he proposes to send a quantity for trial by any person whose name the club may suggest.

Dr. Isaac P. Trimble, Entomologist.—I hope, Mr. Chairman, we shall have nothing to do with remedies unauthorized by the deductions of scientific research. This application of a substance called shale—it must be a nostrum. Science ignores it; entomologists have not written about it. It is contrary to the nature, the birth, modes of living, and the death of these animals to suppose that a dusting of ground rock can terminate their earthly career.

The Chairman.—We know no law superior to that of experience. If these men in Western New York have found, in a great number of instances, that a particular rock pulverized is an effectual remedy, it must be accepted as a fact, no matter what science affirms. Some shales are rich in carbonate of lime; others have phosphate of lime. Mr. Thompson says that fine ground bone drives them from his vines; others have found plaster effectual. We shall be glad to make trial of the pulverized shale of which these gentlemen speak.

Adjourned.

June 22, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

A Coughing Horse.

Mrs. M. A. Dewitt, Fidelity.—Will you, or some of the Club, please give a remedy for cough in a horse. I have a fine animal that last fall took a cough. In the winter he had distemper, which left

the cough worse. We have tried several remedies which have done no good; among them condition powder and flaxseed. Please give me some advice in this case, and oblige.

S. E. Todd.—The cough is doubtless attributable to one of two causes—bad ventilation of stables, or musty and dusty hay. I occasionally pass a small and close stable in Brooklyn, in a basement, from which I saw them taking out the third dead horse within a few months past. The death of those noble animals was caused by inhaling the poisonous effluvia that arose from their own droppings. Each died with a severe cough. Very dusty hay, like bad clover hay, will poison horses of a delicate organization. The remedy is pure air and cut feed, or roots and grass. If hay is dusty it should be sprinkled with water. The best treatment for a horse that, like the one described, has an established cough, is to turn him out to pasture for a couple of months. This will apparently cure him, but the complaint will reappear if he is put on dry hay in the fall. But if he is well cared for, in a sweet stable and fed with moist food, especially roots, the cure will be lasting.

MARL MONOPOLY.

Mr. John Wilson, Bridgeport, Cumberland county, N. J.—I have seen several notices in the published proceedings of the Farmers' Club, of the offer made by the New Jersey marl companies to present the members of the Club with fifty or more tons of marl for trial. I should like to say something of our experience with marl and marl companies in this country. When the article was shipped by rail to Bridgeton, I believe the price was $1.25 per ton. It was found to be beneficial to grass crops, and the demand increased. The noble-minded company then put the price up to $1.80, but as corn and wheat were bringing high prices, the demand for marl still increased. Generous company, believing the farmers will stand another turn of the screw, go up to $1.90; another turn and it is $1.95; another and it is $2.10. Now it is this steady advance of price, while farm crops are steadily falling, that I protest against as unfeeling, and in the end a short-sighted policy for the companies and the roads. I have found bone dust to be a better manure than marl, especially for grain, and less costly. I believe a dressing of 300 pounds of bones to be equal to ten tons of marl. All we farmers know about the marl, is that it costs more and more each year, and this policy driving us to other commercial manures. We have some little curiosity to know what divi-

dends are now paid to fortunate stockholders in marl companies. Hereaway we are kept in blissful ignorance of these things, for these stockholders, being gentlemen of "position and fortune," cannot be expected to discuss the matter of their profits with sunburned farmers.

Dr. Isaac P. Trimble.—This letter opens an abuse of the greatest significance to rural advancement. For my part I believe the railroads would find their account in passing all manure trains free. If not thus, then at the lowest figure that will cover bare cost of moving the fertilizers. At any rate, a monopoly of such article as marl, and this is what the Jersey roads are aiming at, is worse than a land monopoly or a monopoly of flour or salt. By spreading this deposit, as the Creator has, in a wide belt across a State and at a moderate depth, He shows that He did not mean with it to enrich a few railroad lands, but to bless the entire population. I trust the subject will arrest attention and influence voting in that State. It is a wonderful manure, and has doubled, yes, trebled the value of many thousand acres; but its beneficent capacity has but just begun if it can have that freedom of commerce and that general application which all our soils require. As contrasted with bones, it is far more lasting in its effects. Near Toms river I lately saw corn that will give sixty bushels to the acre growing on land that was marled ten years ago by hauling it fourteen miles over a sandy road.

Mr. J. W. Gregory.—I do not agree with the gentleman in calling bone a transient manure.

The Chairman.—That depends on how fine they are crushed. If you grind them to a fine flour bone will act at once, and will spend its strength on the first and second crops. But when they are crushed merely their effect lasts many years, as many as seven or eight. On fast growing crops I recommend the fine bone flour, but for fruit trees and grape vines, the coarse.

A Steam Plow.

Mr. T. C. Peters.—I would like, Mr. Chairman, to give the Club a little sketch of the steam plow lately imported by a gentleman in Atsion, on the Delaware and Rariton bay railroad. He is going largely into the sugar beet industry, and has imported this plow for the use of the whole community. Two engines are stationed over against each other, and a wire rope is wound on a drum, first by one, then by the opposite. To this rope the plows are attached; there are six plows going one way, then six the other, on the same frame.

The frame tips up, so that while one row of plows does their work, the other six are in the air. The rate of motion was rapid, as fast as five and one-half miles an hour; and the strip plowed at each passage was six feet wide. Those who saw this trial were convinced, as the English farmers have long been, that steam can replace the horse in all the heavy and slow farm operations. These engines are able to move about by their own power, and might, on level land, be employed in hauling manure, crops, &c. They can drive a wheel, from which power may be obtained for thrashing, cutting hay, husking corn, sawing wood, grinding, and lighter jobs.

Prof. James A. Whitney.—It is the opprobrium of the Yankee brain that it has not been able as yet to apply steam to tillage, except at a cost which puts it quite beyond the average American farmer. The Fowler plow, of which Mr. Peters saw a specimen, costs from $12,000 to $15,000; so that counting interest on investment, hire of engineer and men, repairs and damage during winter and in harvest, it is an expensive implement compared with the common two-horse plow. But it can and will be proved that Yankee is as much ahead of English expertness in steam-plowing as ship-building, and making iron-clads. Mr. Hall, who has paid special attention to this subject, will, in a short time, read a paper on the steam-plow as now understood in this country.

Plaster on Clover.

A short letter was read, asking the Club to prove that it is better to sow plaster on the leaf of clover when it first comes up, than to apply it to the soil before seeding.

Mr. T. C. Peters.—In several counties of western New York, as Onondaga, Cayuga, Seneca, Ontario, and Wayne, the farmers make it their business to know clover. The best farmer there is the one that understands most about *trifolium pratense*, as my friend Todd loves to call it. They have observed that clover, sprinkled with plaster early in the spring, grows faster, looks greener, heads sooner, and cuts heavier than when top-dressed in any other way. That is all the proof any practical farmer wants to go by.

Prof. James A. Whitney.—Leaves cannot absorb a mineral. Plaster must go down and mix with the soil, and be dissolved, before it can help a clover plant. But the supposition about this remarkable form of lime is, that it has the faculty of absorbing ammonia out of the air. If it does this, it should be aided in a service so important

by being spread thin on the leaves so as to come in contact with the air. After being thus enriched by absorbed ammonia, rain washes the plaster off and the roots get it. Carbon may be drank in from the air, but ammonia must get in through a root or not at all.

The Alkali Earth of the Rocky Mountains as a Fertilizer.

Judge J. G. Knapp, Madison, Wis.—During a residence of many months in the central regions of this great continent, I took note of the available mineral and agricultural resources of those territories. Perhaps it is not generally known that much of the material commonly known by travelers as *alkali*, spread in vast deposits on our western plains, and which the Mexicans call *salitra*, is a compound salt, of which nitrate of soda is a large constituent; the other ingredients consisting of carbonate and chlorate of soda, with salts of potash. Some difference in composition exists in different localities. Besides the useful arts to which it may be applied, salitra supplies the place of salt to the cattle and sheep; and though poisonous to vegetation where it exists in excess, yet in smaller quantities, but sufficient to be plainly visible by its inflorescence, it is a valuable manure, especially for wheat, beets, and onions, and causes New Mexico to produce such fine grapes, peaches, and quinces as can be found in no country where this salt does not exist. The apple tree and cotton-wood, and some other forest trees, are benefited by its presence. There are places, particularly in New Mexico, where it might be gathered in almost inexhaustible quantities. Would not it make a valuable dressing for vines, quinces, peaches, and other crops, and thus pay for collection and transportation? Where I have seen it there are no "large accumulations of decaying organic matter" to furnish the nitrogen for the formation of salt, and, therefore, I am of opinion that the nitrogen is derived either from the atmosphere, during the hot, dry seasons, or from the ground through some, to me, unknown volcanic action; as all the hot springs yield some of the combinations of this alkaline earth.

Mr. J. B. Lyman.—The Club has long thought that the deposits on the alkali flats of the wide central plateau of this continent, though now condemning those surfaces to sterility, might prove a valuable manure on lands where potash and soda are not abundant. They would suggest to some readers of these reports, who live near those regions, to forward a barrel of alkaline earth to the American Institute of New York city, to be used experimentally as a manure.

PIONEER INDUSTRY.

Mrs. Kittie Miller, Erie, Neosho county, Kansas.—Perhaps the Club would like to hear from this far-off place in the West. We arrived here the 5th of July, 1868, and now, after almost a year's stay, we cannot speak too highly of our western home, with its thousands of acres of prairie stretching far and wide, dotted here and there with houses, each owner beautifying his quarter-section by planting fruit and forest trees, turning over the sod with double teams, preparing it for crops of corn, potatoes and grain. At this season of the year the prairies are blossoming with millions of wild flowers, the fragrance of which fills the air all around, making Neosho indeed a delightful place to live in. Immigration is rapidly coming in. Not six months ago we thought we were far out on the frontier, but now we are considered back in the settlement, so fast are the people settling it up. The 160 acres that I call home, which the Giver of all things had permitted to remain untouched by man or plow until we took possession, is undergoing a gradual change. We have a hewn log house eighteen by twenty-four, a story and a half high, and here permit me to states that the country has passed from the first stage of log-houses to the second stage of frame, which adds both to the wealth and looks of our country. Still, I love the old log-house, with its climbing vines and roses. As yet we have nothing but wild vines to adorn ours with, and a few of the common flowers. We have a good well of water, twenty feet deep, which was dug during the dryest time last summer, upon high land where our house stands. We have over 300 fruit trees of different kinds, some two years old; also, some forest trees, some currants, strawberries and grapes. Our stock consists of two cows, two calves, and two yoke of oxen. From our two cows we make butter enough to serve six in family, and sell from six to eight pounds per week. As this is our first attempt at farming, we think we do well. This country is well adapted for fruit, small grain and cattle; the latter do well in wild pasturage. As to health this is the place to come to enjoy that great blessing, for it is the testimony of all that this is as healthy a place as can be found. Some of our difficulties, perhaps, would not come amiss, and the discouragements we met. When we first came here we lived for five months in a muslin tent, which was poor protection from the sun, the wind, the rain and the snow. Owing to the hot weather in last July and August, it was impossible to work in the timber, and when the weather became cooler it rained

almost incessantly, and we had to haul our house logs four miles through the mud. But as ex-President A. J. says, "There is life in us yet;" and we enjoy it better than when living in town dependent on others for employment. On the 8th of last December we moved into our house without any doors or windows, and not all the floor laid, and no pointing in. I have taken a claim, and am going to try farming next year by planting about five acres in potato. Odd and even sections are alike being settled, and the only question now is, how will we get our land, as rumors abroad are that the railroad will get the odd, and settlers will get the even at $1.25 per acre, but as yet nothing definite is known here in regard to it. A railroad would be a very nice thing, but a home for the industrious poor, better.

GOOD COWS.

Mr. O. P. Laird, Mesopotamia, Trumbull county, Ohio.—How much ought a four-year old heifer to give that she may be called a good one? One of my neighbors and myself were discussing the above question, and each regarding his four-year old the better, we agreed to weigh milk for six consecutive days, with the following result, as per table inclosed. These were cows kept in a dairy, having no extra feed, the time being just between hay and grass:

No. 1—A four year old.	Morning.	Evening.	Total.
May 10	18	20½	38½
May 11	18	22	40
May 13	19	22	41
May 13	19½	22	41½
May 14	20	21	41
May 15	22	21	43
Total			245

No. 2—A four year old.	Morning.	Evening.	Total.
May 10	18	21	39
May 11	18½	21½	40
May 12	18½	22	40½
May 13	19	22	41
May 14	19	22	41½
May 15	20	22½	42
Total			244

WEEDS.

Mr. S. W. Hemingway, East De Kalb, N. Y., sends a weed that has got into his clover seed. What is it? If foul, how can I get

rid of it? Many of my neighbors are in the same fix; it is new in these parts.

Dr. F. M. Hexamer.—The weed is *Lanceolata plantago.*

The Secretary.—On referring to Darlington I find the following: "*Lanceolata plantago*—Rib grass, English plantain, buckhorn plantain. This species, also, is extensively naturalized, and is particularly abundant in upland meadows, or choice grounds. The seeds being nearly the same size and weight as those of the red clover, they cannot be readily separated, and thus the two plants are disseminated together in the culture of clover. Nearly all kinds of stock eat this plantain freely, and it has even been cultivated expressly as a sheep pasturage, but it is generally disliked in Pennsylvania. I do not, however, perceive any mode of getting rid of it, or even of arresting its progress, unless it can be choked down by heavy crops of clover and valuable grasses."

A Lecture on Strawberries, with Illustrations.

Dr. F. M. Hexamer, from his example farm at New Castle, Westchester county (two miles from Mr. Greeley's), brought before the club twenty or more varieties, and as he dispensed the luscious berries he sandwiched them between such clear and pertinent talk as to make the whole a savory short-cake. Strawberries, said the Doctor, are of two general sorts. 1. Market varieties, 2. Amateur berries. In the first class I set but three: First, the Early Scarlet; this has brought growers a great many thousands of dollars; it is an early, cheap, small and prolific berry, that was the earliest Delaware and South Jersey variety till Virginia came in competition. At present I cannot recommend it for market raising. Second, the Wilson. Were all other varieties wiped out, the country would suffer but little in pocket, and not much in purse. It has every requisite for a popular berry. It is hardy, prolific, bright in color, firm in flesh. It can be carried great distances, and kept many days. If any one asks of me which variety I say without hesitation, Wilson. Third, Triomph de Gand. This is a fancy berry. It requires care, deep culture, high manuring; but it brings just about double the price of the Wilson. I sell my Triomphs for forty-four, forty-six, fifty cents—none less than forty-two cents—some over fifty cents by the crate. But the Triomph will bear no neglect; it requires deep plowing; I go as far down as twelve inches, and plow often between the rows. The second general division is the amateur berries in private beds. Here

we have a great assortment, with wide difference of flavor, time of fruiting, size, color, hardiness, certainty and fullness of bearing. But they agree in this, that, either on account of softness, of sourness, irregularity, or some other characteristic defect, they are none of them suited to general planting for money. Their place is in the bed of the family garden, or the collection of the amateur. Here is *Jucunda*, an excellent berry, but irregular as a bearer—last year good, this year scanty; the New Pine, fine flavor but soft and must be dead ripe; the Stringer Seedling, soft, early, bad shape; Boyden's 30, of splendid size and noble color, but soft, often hollow, ripening in spots; Barnes' Mammouth, very large, quite hardy, keeps quite well, very prolific; the Charles Downing, for home use, a splendid berry, big, round, luscious, uniform in size, a good bearer, too soft to go into a crate; Nisanor, hardy, prolific, curious taste, something like a gooseberry, all of good medium size; the Great Eastern, very late, just now in bloom.

Mr. A. S. Fuller.—What of the Romeyn?

Dr. Hexamer.—The identity of this berry with the Triomph has been much discussed. I think it is a different berry. It grows higher, fruits better, and grows where the Triomph will not. The flavor is a little sourer and does not pall upon the tongue.

Rev. Mr. Foster, a gentleman interested, took the stand and spoke briefly to the effect that several cultivators at Milton, on the Hudson, had found a decided dissimilarity. The Romeyn, they say, is solider, and has higher flavor. Mr. Foster further stated that he had received sixty cents per quart all the season through for the Romeyn, while the Triumph only brought forty cents. Another advantage of the Romeyn is that it grows well on sandy land, while the Triumph, as Dr. Hexamer remarked, requires a heavy clay loam. In conclusion Mr. Foster read a letter from John Cadness, a well known fruit grower at Flushing, L. I., who stated that he had grown the Romeyn for two years, that he finds it much more vigorous and hardy than the Triomph, and that it stands the sun much better.

Dr. J. V. C. Smith.—For my part, Mr. Chairman, I have been delighted with this exhibition, and this admirable discussion of the varieties; it covers the whole ground, and comes from a gentleman fully master of his business, and an expert in small fruit culture. I move the thanks of the Club. This was unanimously carried.

Sweet Potatoes—How to Keep.

Mr. Truman Mabbet, of Vineland, New Jersey, was present, and exhibited a basket of sweet potatoes, some of which were grown in 1867. They were in appearance as fine as ever, and a few specimens baked for the occasion proved that appearances in this instance were not deceptive. Mr. Mabbet said, in explanation of the process, that it is very simple, namely: Keep the tuber dry. I plant about May 25, or as soon as there is no danger of cold snaps. In October, when the vines are withered, dig in the forenoon of a fine day, and in the afternoon put into barrels, and transfer at once to the cellar. Here the barrels are placed in proximity to the heater, where there is a temperature through fall and winter of about seventy or eighty degrees; but no fire is kept up during the summer season.

The Chairman.—This exhibition speaks for itself. The question how shall we keep sweet potatoes has been asked a hundred times, and now we have the answer. We are greatly indebted to the gentleman who has come so far to furnish the valuable information.

Bolts Through Trees.

Mr. E. P. Allen, Athens, Penn.—We have in our neat and time-honored village a large number of sugar maple trees, many of which have become large and very beautiful. Some of them were left forked (or as the anatomist would say, bifurcated), and now are occasionally splitting apart and breaking down. The question now is what the best remedy is to prevent the destruction of the remainder that is forked. It is proposed by some to pass a bolt through the center and hold it by a nut screwed upon the opposite end; by others to pass a strong iron clamp around the tree near the crotch. Which of these methods is the best, or are there any other methods better? Any information upon the above subject will be thankfully received by the citizens of Athens.

The Chairman.—A bolt with a big head and a large nut is the best for two reasons: 1. It takes less iron. 2. If the tree is vigorous it grows and buries both the head and the nut. Numbers of the ancestral elms of New England have been ironed in this way, and have reached a lordly size.

Adjourned.

June 29, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Composting Muck.

Mr. John Brown, Peru, Clinton county, N. Y., wished particularly to know if it would pay "to dig and haul muck a half mile to the barn-yard, and there compost it with stable manure, and transfer it thence to a poor sandy ten acre field within twenty rods of the place from which the muck was taken, or would it be cheaper to cart it to the field directly from the swamp?"

Mr. N. C. Ely.—My experience and observation commend the practice of leaving muck exposed to the cold of winter. It is, I think, much better and more available as a composting material after having passed the freezing and thawing which such exposure ensures.

Mr. H. T. Williams.—During a late visit to the farm of our excellent friend, Dr. Hexamer, I learn that his custom is to mix muck and manure fresh, in equal proportions, and let the compost remain for several months. The tillers of the soil at Milford, Conn., draw muck in summer and fall, and compost with fresh manure at once. Of course, it is best not to have the muck too wet.

Mr. J. B. Lyman.—In talking with many farmers about the benefit they get from muck, I have in only one case seen positively fine results from the use of it when spread fresh from the swamps. One field I was shown where the crops were conspicuously better for years for a dressing of 100 loads per acre from a swamp close by, but this was not muck exactly, but leaf mould. Another farmer, as good as any in Connecticut, many would say the best, hauls his muck three miles and mixes it with the droppings of his farm animals every day summer and winter. Thus his pile is trebled; for a bushel of yard droppings mixed with two bushels of dry swamp muck and allowed to stand some months will be found as strong a fertilizer as three bushels of yard droppings. They mutually aid each other. The most valuable and the most subtle parts of yard manure fly away and vanish in air, unless fixed by some chemical art. The sourness of swamp muck has the power of fixing this volatile part of excrements. At the same time the sourness is removed. Hence I would advise Mr. Brown to haul his muck a mile; two; yes, three miles for composting it, rather than apply it raw. He will find his account in so doing, for the free use of muck in his yard, about his

drains, his roost, and his stye, will kill all noisome smells, and remove what is frequently a nest for slow and lingering diseases.

Dr. J. D. Peck.—This subject is an important one to all farmers. Those who have no access to muck had better use earth. The application of loam does away with all offensive odors. I am in favor of muck first, but loam is a good substitute, and if loam is not available, then clay is much better than nothing.

Decomposing Turf.

Mr. Elijah Ware, of Salem, N. J., wrote as follows:—"Will you please inform me what disposition I had better make of some hundreds of loads of turf taken from the water-course along a meadow of mine recently by a steam mud-digger. A great deal of it is simply turf without any vegetable matter, or but little in it, is very light when dry, and would burn quickly. Could I make a compost with lime or some other substance, to use next year on my truck field, pay?

Prof. J. A. Whitney.—Unless on a heavy soil the turf will do but little good applied alone. Its decomposition will be hastened by mixing it with lime and letting it lie exposed to the weather. When pretty well reduced, and in a dry condition, it would answer well for composting with highly organic manures, which is the best use it can be put to.

Dr. Isaac P. Trimble.—I don't see what better thing he could do than to transfer the turf to the low marshy places, provided there are such on his farm.

An Insect Enemy.

Mr. W. F. Goble, of Pleasant Ridge, Kansas, wrote that he had noticed during the past twenty years in Iowa, and other States where spring wheat is raised, that what is called the chinch-bug becomes more or less a pest. "Has it ever been settled whether or not this insect peculiarly accompanies spring wheat, and can the Club give the laws and history of its operations?"

Dr. Isaac P. Trimble.—This is a minute species of bed-bug. It increases immensely in the great wheat-growing regions of the country, but fortunately the weather is sometimes such as to militate against its operations. There has been much written on the subject, and drawings have been made which would be interesting and helpful to our correspondent.

Mr. T. C. Peters.—There is a periodical published at St. Louis, Mo.,

namely, The American Entomologist, which is especially devoted to the subject of insects injurious to farm crops. It is edited with care, by gentlemen of ability, and it ought to have a large circulation among the class which it is especially intended to benefit. If our Kansas friend had read the Entomologist, he would ere this have come upon a full and helpful account of the pest complained of.

Middle-men.

Mr. Charles W. King, of Sumenburg, Essex county, Vt., wrote as follows:—"I wish to know if there is not some way that farmers may escape the grasp of the 'middle-men'—those who come between the producer and consumer? Take, for instance, our beef. There is the drover with his runners, the butcher and the stall men. The result is that the consumers pay double, and often more, than we, the producers, receive. It seems to me that by a combination of effort these 'middle-men' may be reduced to some honest or legitimate business; but I am at a loss to know the method of operation."

Mr. W. S. Carpenter.—I have reason to hope that the evil will be remedied, and that at no distant day. I am informed that arrangements are being made by an association of industrious individuals in Ohio, to transfer beef in refrigerator cars, and in such a manner as to do away, to a great extent, with the hitherto necessary "middle-men."

Mr. J. W. Gregory.—There is a steamship, the William Taber by name, now fitting up at the foot of Nineteenth street in this city, for the purpose of bringing Texas beef to the northern markets. There will be facilities for making ice on board the vessel, and preserving the meat by driving a current of cold air through the apartments intended for its reception. The air is not only cold but dry, and the cold is intense enough to turn a room full of beef into stone in an hour. But that degree of frost is not found the best. I regard this as a very important experiment. When in Texas, not long ago, I was offered 1,000 head of cattle for $15 apiece, and each quarter was warranted to weigh from one hundred and fifty to one hundred and sixty pounds. This beef was excellent, much better than most of that brought from long distances, offered in the metropolitan market. If the vessel alluded to prove able to perform the work, and I see no reason to apprehend a failure, there will be better times for the denizens of our great city, particularly for those who need beef most, and now have the least of it.

Mr. J. B. Lyman.—This question of the quality of Texas beef is misunderstood. Some years ago business took me several times over that State. I was repeatedly in western Texas, late in the fall, early in spring, and in midsummer. I never saw a poor animal in all the country where the mezquit grass grows, and never ate more juicy or well-flavored beef than that fattened on these prairies. If the animals can be slaughtered on or near those great plains, Texas will afford us the choicest of animal food in great abundance. But if the half wild bullocks, worried, frightened, thirsty, and starved, tortured by musketoes, and sickened by foul water, are killed and transported in bulk by the Gamgee process, or by the Lowe freezing process, they will give us tenderloins as tough and tasteless as they are cheap. The mezquit grass is a companion of the mezquit bush ; this is only found in western Texas. It is a grass that dries into hay with all the starch and sugar in it, and affords as rich and fattening a bite in January as it does in June.

THE TEN-HOUR SYSTEM.

Mr. J. M. Ingalls of Springfield, Otsego county, N. Y., forwarded a communication giving his ideas on this subject: "It seems to me that no apprehensions need be felt. The relations of capital and labor are not controlled by legislation but by necessity. The ten-hour rule will not apply to farming, because from the nature of things it cannot. Labor from sun to sun will be the rule for the farm, because certain kinds of labor, the care and feeding of domestic animals, for instance, must be done at certain hours of the day—early in morning, at noon, and at night. Suppose our Legislature enact a law that ten hours constitute a day's labor on the farm, it amounts to nothing. It does not prevent me from hiring a man to work all day instead of ten hours; neither will it affect the price of labor one iota. The price of labor, like that of any other marketable product, is regulated by the law of supply and demand. Legislation will hurt no one, and benefit no one. Mr. Powell is reported as desiring a fixed standard for a given number of hours of labor; for instance, two dollars for nine hours. Nine hours labor in one locality may be worth two dollars; in another, three dollars; in another, one dollar. The price of labor in the same locality varies with the seasons and fluctuates like any other market value. Again, there is every degree of capacity and aptitude in the laborer. One man is worth fifty cents a day more than another. Establish a uniform price

and you defraud this man and over-pay that. Farm laborers in this country are already well paid, and, so far as I have observed, satisfied with what they receive. The labor movement is inaugurated by a class of politicians, and not by those for whose benefit it is claimed.

EARLY POTATOES.

Mr. Spencer Springstead, of Union Port, Westchester county, N. Y., sent specimens of potatoes, the fairest and finest of which were the "Early Rose." He planted some seed of this species on the 20th of April last, and on the 18th of June they were large as the largest goose-eggs, and of excellent quality. The "Early Goodrich" and "Sebec" were planted side by side with the "Early Rose," but they were very much smaller at the date of digging, and quite immature. From which facts Mr. Springstead draws the logical conclusion that the "Early Rose" is far ahead of these competitors.

Mr. J. B. Lyman.—On the morning of April 9, I rose early, for the purpose of planting an "Early Rose." It was a nice potato, one of the premium potatoes that Mr. Fuller sends to those sitting in darkness, when The Sun rises upon them, and I was tempted to see how it would taste when boiled; but discretion got the better part of appetite, and so I trusted the prize to the kindly soil of South Jersey, and the suns of opening spring-time. Well, no later than the 25th of June I took my hoe (which I always try to keep well polished) and gently opened the hill in which my hopes were buried. There I found the compensation promised to patient waiters. There was an eighth of a bushel of fair tubers, fully ripened, and excellent. Lest I make you all unhappy, I shall generously refrain from any description of the joys which were mine when the mealy morsels appeared upon my breakfast table. The seed weighed twelve ounces, the crop nine pounds.

Mr. W. S. Carpenter.—The ratio of increase announced by our friend Lyman is not so large as in some instances of last year's growth. I am credibly informed that 100 pounds were produced during the spring of 1868 from one pound planted. From what I can learn, the "Early Rose" is likely to retain its old reputation, and even supersede every other candidate for public favor.

Mr. P. T. Quinn.—I saw the "Early Rose" for sale in the markets as I came through to-day, at $5.50 per barrel; and the commission dealers with whom I spoke were quite enthusiastic in their praises.

HINTS ON HAYING.

The regular paper of the day touching this timely topic, was presented by Mr. S. Edwards Todd, a gentleman of large practical experience. Certain errors are cherished by many farmers in regard to the best period in the growth of grass for making hay. And some absurd notions have been promulgated in years past in regard to the manner of curing hay, in periodicals claiming to be correct agricultural authority; these errors continue to be propagated, from year to year, by men who never made a ton of hay, and who are utterly ignorant of the fundamental principles of this branch of agriculture. As beginners come in possession of meadows, every season, they naturally aim to be guided by the most trustworthy authorities on hay-making. As the blind continue to lead the blind, the result has been, and will continue to be, so long as such errors are promulgated, that dumb animals are required to subsist on moldy, musty, and unpalatable food, when, with no more labor, their daily ration might be a liberal supply of sweet-smelling hay. At what period in the stage of the growth of the grass do animals eat it with the greatest avidity? Of course, when the leaves and stems are fresh and green. Now, then, if it were better for the animals that the fresh grass should be covered with a sprinkling of mold and have a musty smell, rather than the delicious taste and the grateful fragrance that green grass always possesses, why did the great Agriculturist of the Universe make such an egregious mistake as to furnish the beasts of the field with such food, when it might have been different? Hay is dried grass, and the nearer the hay resembles fresh grass the more excellent the quality will always be. Here, then, we have a sure starting-point to enable us to decide as to the proper stage in the growth of grass to cut it for hay. Hay made of grass cut before the blossoms have appeared, will be better and more fragrant than if the grass had been allowed to stand until the flowers were in full bloom. Yet, if this period were chosen for cutting grass, the hay would be excellent; but a great loss would be sustained as to the quantity. Therefore, by allowing the grass to grow until the blossoms have nearly all appeared, we have the double advantage of that stage of growth which will make sweet-smelling hay in the largest quantity that it is possible for a given meadow to yield. As the period for cutting grass is chosen either before the blossoms have appeared, or after they have fallen, there will be more or less loss, according to the nearness, or remoteness of that period in the stage of growth, either before or after

the grass is in full bloom. After the blossoms have fallen, the material that would have made the best of nourishment for domestic animals, changes rapidly into unpalatable woody fiber, which will furnish animals no more nourishment than corn-cobs and sawdust. Great weight and bulk of fair-looking hay may be obtained by allowing grass to stand until the blossoms have disappeared. But the quality is quite inferior. When druggists and botanical physicians gather plants and herbs for medicinal purposes, at what period in the stage of the growth do they cut them? Always when they are in full bloom, if it is practicable. And why at that particular period of development? Because, they know that when herbs are gathered at the period of full bloom, the stems and leaves will yield a larger per centage of aroma and medicinal qualities than if cut at an earlier or a later period. The same fact holds equally good of all kinds of green fodder, including the grasses, clovers and maize. Grass that is cut when in full bloom and properly cured, without bleaching, or too much scorching in the sun, or sweating, or heating in the mow, will make hay resembling grass so nearly that the hay will furnish almost as much real nourishment to those animals that eat it as it would yield in a green condition. If grass be allowed to stand until the seed has matured and the leaves and stems have become dry, the hay made of it will go much further than if the grass had been cut when in full bloom, on the same principle that the flour made of unsound wheat will go much further than an equal number of pounds of choice flour, when made into bread. Stock will often eat very poor hay with an apparently good relish. Hunger sharpens the appetite; and they must eat such food as has been prepared, or do worse. But it is by no means a just argument, that because stock eat poor hay with avidity, all grass should be allowed to stand until it will yield the largest quantity of inferior fodder. The correct point, then, is to cut grass for hay when the blossoms are fully developed.

Dr. Isaac P. Trimble.—It is a mistake to cut timothy when in blossom. It makes the hay dusty, on account of the great quantity of pollen thus collected.

Prof. J. A. Whitney.—There is a scientific principle involved in this matter, which goes to show that Dr. Trimble is mistaken and Mr. Todd is right. In succulent plants the sugar and starch increases until the flowering culminates; but when the seed begins to form, the sugar and starchy matter are cemented into an indigestible,

woody substance. The dust of timothy blossoms cannot be a tithe of the quantity mixed with hay by the use of the horse-rake.

Mr. W. S. Carpenter.—There can be no doubt that it is much the best to cut grass when in blossom. It not only makes better hay, but it exhausts the soil much less.

Prof. J. A. Whitney.—That is in accordance with correct theory. The growth of seeds takes much more phosphoric acid from the soil than herbage does. Cut grass when in bloom, and you will have the best quality of hay, without taking the manurial substance from the soil that will be needed for the next grain or seed crop.

SOWING PLASTER ON CLOVER.

Mr. Joseph Heighton, Kent, Portage county, Ohio.—"Last spring I had three and one-half acres of land; the soil was sandy and gravelly; the piece had been cropped about thirty-three years, sowed only twice to clover, which was mowed and taken off, and had no manure applied all this time; and the land was bare, save here and there a mullen stalk, or creeping blackberry vine. I sowed it to rye in the fall, and clover the next spring, the 1st of March, when the snow was on. When the clover was about three inches high, last spring, I applied one bushel of plaster on the three acres, leaving the half acre without any plaster. The result was, I had three acres of as good clover as I ever saw growing, really beautiful to look upon; but the half acre that had no plaster was poor enough, and any one can see the exact line where I finished sowing the plaster, when they are twenty-five, yes, thirty rods away from it. Now, I would ask the Club whether it would be best to plow it, the clover, under, about the 1st of June, or take one more crop off first, and plow the second crop under, and sow to wheat in the fall?"

Mr. J. B. Lyman.—Our Portage county friend will not be wrong, if he takes two crops of clover before he turns under for wheat; but the more approved course is to wait till the following spring, and turn the clover when it is hoof high, and put corn on it. Corn requires sod more than wheat does.

HOW TO MAKE SHINGLES LAST.

Mr. George O. Smith, Springfield Centre, Otsego county, N. Y.—In reading the proceedings of the Farmers' Club, I noticed discussions on the different processes of preserving timber. Can you give me any process that will make sawed cedar shingles last longer, and

at the same time be simple and cheap? Would it be a benefit to dip the bunches in boiling lime water?

Mr. J. B. Lyman.—You cannot do a better thing to those shingles, Mr. Smith, and this is the reason why. Cedar shingles have a peculiar sourish, woody smell. A soaking in lime water would mostly destroy that. If the lime water is boiling, it has two effects, killing the acidity and stiffening the albumen in the wood. This albumen it is that supports mold and the mosses. Cook that, and your roof will not be mossy. Boiling in lime water makes the meanest shingle as good as the best. It helps chestnut amazingly, and this sour smelling red oak. Then, if afterward you give the roof a good coat of tar paint, it will be likely to outlast all the men that worked on it.

Westchester Black Cap Raspberry.

Mr. L. J. Mabee, Tarrytown, N. Y., exhibited specimens of the Westchester Black Cap Raspberry.

Messrs. Trimble, Cavanagh and Todd were appointed a committee to report on the same.

Grass Seed Sifter.

Mr. Isaac Baldwin, Antrim, N. H., exhibited a grass seed sifter, which he wished examined in operation.

Messrs. Todd, Carpenter and Lyman were appointed a committee to examine.

Corn Cultivator.

Messrs. Kent, Baldwin & Co., Middlebury, Summit county, Ohio, sent for examination one of their improved corn cultivators, which was referred to Messrs. Quinn, Bruen and Carpenter to test its qualities and report.

A Patent Wheel.

Messrs. Monk & Williams, of New York city, exhibited a wheel of novel construction, and which seemed to possess some advantages. The hub is of gun or malleable iron, into which the spokes are dovetailed. The inventors claim that if a spoke is broken a new one can be substituted without removing or cutting the tire; further, that there is no chance to knock the dish out, or cause it to become more dishing, and lastly, that the wheel can never be rim-bound.

Adjourned.

July 6, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

SHALL HE RUN IN DEBT FOR A FARM?

Mr. Samuel Ware of Huntington, Mass., wrote to solicit the advice of the Club as to the propriety or impropriety of borrowing $400 with which to buy an acre of land; also, if bought if it would be a good idea to plant it with wild blackberries gathered from the fields.

Mr. J. W. Gregory.—This young man evidently means well, but is likely to start life on a wrong basis. He had better earn his money first, and never forget the sturdy old maxim, "pay as you go." Besides I don't see the sense in his giving $400 an acre for village lots, when by going away a short distance he can get as good soil for $100 an acre. Will the location alone be worth $300 to him?

Mr. A. S. Fuller.—I disagree. I believe a beginner, if he has the right metal in him, will find it an advantage to be crowded, as he would be if he run in debt for land. If he buys it he must pay for it, and ten to one he will pay for it. I remember one person in particular, who shall be nameless here, who, had he not acted on this principle, would have been poor to-day. He is not poor to-day, but pays the taxes on property of which he may well be proud.

Mr. Thomas Cavanagh.—In answer to the other question, I would advise that correspondent, or any other person who is commencing life for the first time, not to undertake to get along with an inferior article because it is cheap. Instead of searching among the brambles for wild blackberry bushes, let him borrow money with which to buy the best, or get some amiable nurseryman to trust him till he can turn the corner. I, myself, would have no objection to supplying him with fifty cuttings of the approved varieties.

Dr. J. V. C. Smith.—I like this talk of our pleasant friend from Brooklyn. I think he exhibits a feeling which ought to have greater sway among us all. When we see young men trying to help themselves let us encourage them, and not screw them down; for thus shall we appeal to their sentiment of pride and honor, and the best consequences will ensue. I have noticed that of all debts those contracted for lands, plants, and buildings are most apt to be paid. Nature has a way of paying up, and she generally teaches that great lesson to those who have much to do with her.

The Ten Hour System on Farms.

Mr. J. W. Colburn, of Springfield, Vt.—I have noticed the discussions on the hours of labor for the farm, none of which, in my judgment, put it upon the right ground or explained it as it should have been done so far as the farm is concerned. In this locality the farmer does not get so many hours' work on an average the season through, or by the year, as is now established by the manufacturers and mechanics. Many farmers hire their help for seven or eight months, from 1st of April to 1st of November or December. There are three of these months that fall short in the hours of labor of the other five months. Now, let us take the five months of the longest days: A man gets up in the morning after the sun rises—it is considered out of good taste to get up before the sun—he does a few chores and waits around the house until breakfast is ready, six A. M.; six thirty he will be in the field ready for a day's work; at twelve he is called to dinner, and it is one o'clock P. M. before he is in the field again; and at five he is called to his supper, and is back to his work again at five thirty; quits work at seven P. M. All told, eleven hours. In common seasons there is not less, counting showers, than one rainy day in a week; some seasons considerably more, and it is seldom that a farmer can furnish work in rainy weather for more than to pay the board of his men; thus nearly two hours of each day in the week is stricken off, leaving a fraction above nine hours a day for these five months, the two or three months is one hour per day less, averaging, perhaps, eight and three-fourths hours of constant work for the season of six or seven months. When we take men by the year, which includes one-third winter for the whole year, one and three-fourths hours less per day will be the average for these months, for we cannot expect to work men in snow, sleet and rain, though the days are short; nor drive them out into the wood lot when the thermometer is twenty-five degrees below zero.

This reduces the average day's work for the year to not over eight hours, in full accordance with the laws of Congress and the late decision of Gen. Grant. This, Mr. Chairman, is no chimera; it is a fair estimate described by facts, and is the experience of one who has employed men, both by the season and the year, for the last thirty years. If other farmers will go carefully into this reckoning they will find it a correct one, unless they have a better faculty to get work out of men in bad and wet weather than has your humble servant. Should the inquiry arise as to what is the cost of this labor here in

Vermont, it is easily answered. It is only, by the season, twenty-two dollars to thirty-two dollars per month, and by the year twenty dollars to twenty-six dollars, boarding and washing furnished in both cases by the employer. In haying and harvesting by the day—laborer risking the weather—$2.50 a day and board. Is not this an encouraging prospect for farmers, particularly for the growing of wool, at twenty-four cents per pound, gold? We are greatly in need in Vermont of the immigration of foreign farm laborers. Thousands of them could be employed at high wages.

Dr. Isaac P. Trimble.—I regard this as a very sensible letter. It goes to show what I have advocated on other occasions, namely, the absolute impropriety of any meddling with the subject on the part of this Club. Let the farmers make their own arrangements. There is no other way. The affair is purely personal in its nature, and the adjustment must be made between the employer and the employed.

To Keep the Bugs Away.

Mr. A. P. Coddington, of Trumansburgh, N. Y., having noticed in the proceedings some directions for preventing depredations of striped bugs, called attention to the fact of his unsuccessful experience with various snuffs and powders, and gave the following as an effectual method: I take a piece of an old newspaper, large enough to cover the hill well, place it over the hill, bury the edges in the ground, then pull it up three or four inches in the center. and it will remain there in the form of a small tent. Then tear a small hole in the top, which will give the plants all the light and air required, and they will grow more rapidly than if left uncovered, as it protects them from the cold nights, while not a bug will get at them. Should it rain hard the papers would necessarily have to be removed and replaced. This is the easiest and most effectual way I have ever found.

Mr. Thomas Cavanagh.—This might do for a farmer who has a baker's dozen of hills, but it certainly would not answer at all for extensive operations. Soot is my remedy.

Mr. D. B. Bruen.—I have used soot with great advantage this season. I took the trouble to throw it on the under as well as the upper side of the leaves, and my infant vegetation was not destroyed.

Strawberry Runners.

Mr. C. S. Weld, of Olamon, Penobscot county, Me., asked the Club to tell him if he had better cut off the runners from strawberry plants set last fall and this spring, and if so, when?

Dr. Isaac P. Trimble.—At once and every five days.

Mr. A. S. Fuller.—There is one rule worth remembering, namely: If you want fruit cut them; if increase of plants, let runners run.

The Tribune Strawberries.

The same correspondent adds: From one plant sent me in November, 1863, by Mr. Horace Greeley, I raised, last year, thirty dollars worth of berries, at twenty cents a quart, forty dollars worth of plants, four cents each, and thousands given away. About one berry in five will measure four inches in circumference, and a few berries four and a-half ditto. This I think is well for this cold latitude. It is much larger than the picture of this berry printed by Mr. Greeley, when he distributed them in thousands all over the country.

Mr. W. B. Halsted, East Porter, Niagara Co., N. Y.—Only a few years have passed since it was a habit to take a team in the most hurrying part of the season, and spend a day in going from five to ten miles, to get an inferior quality of strawberries, from which we had to pay from ten to twenty cents per quart. The day is yet within the bounds of memory when our intelligent "farm help" brought from the post-office, and laid upon the fence, in the hot August sun, three strawberry plants. By some accident his mind, several hours afterward, caught up with his morning's work, and the plants were remembered, and were set. The next year we gathered no fruit, but had a large number of plants to set. We set the Ellsworth in a bed containing one rod, and from this bed we gathered, the next June, seventy-two quarts of better berries than we have ever seen offered in market. Thus were we stimulated to raising the best fruit; the best kind grown in farmers' gardens, and we would now never think of living through the summer without berries.

Thousands, I presume have come to the same conclusions ere this, who, ten years ago, deemed it impossible to raise their own summer fruits.

We owe much to the Tribune. The value arising from the distribution of those 480,000 plants can never be counted in dollars. That distribution gave life and energy to the feeble and partial growth of fruit culture, until it has extended to every hamlet of the northern union, and is following the advance of civilization south and westward.

Millions may bless the proprietors of the Tribune for the benefits they yearly receive from the fruit they so opportunely disseminated.

We have tried numerous varieties, but have found the Ellsworth best adapted, over all others, for family use; when receiving the least culture, it is more productive than any other we have tried.

Jacob Tschudy, Monroe, Green county, Wis., another receiver of these strawberries, will give his humble report of this delicious fruit. My son planted the roots as soon as received, beside a bed of the Wilson's and other strawberries, but The Tribune strawberry is certainly the largest, best and richest fruit of all we ever enjoyed yet, and we shall set out no other this season. Mr. Greeley merits the thanks of the immense number of the readers of his paper, for his magnificent present, which will be a lasting benefit to everybody throughout this whole country.

Sweet Potatoes, North.

Mr. J. Allen, of Fountain Garden, Conneaut, Ohio, wrote that sweet potatoes are grown in the northern part of his State and in Pennsylvania, with success, and he mentioned a Mr. Gilbert who had grown them for nearly forty years. So, he says, you may tell the gentleman in the mountains of northern Pennsylvania, that they are grown farther north than his locality, and I think if he will obtain good plants from good seed, that he will have no trouble. Hundreds of thousands of sweet potato plants are produced here in warm and sheltered side-hill gardens for home use, and for sending by mail or express to nearly all the States, so that they are grown much further north than many suppose. Last year I procured some seed potatoes from West Jersey, and find that they produce potatoes of a better quality than those that have been grown before here for several years, and I think that they should be renewed often from that locality or Delaware, for as good potatoes are grown there as any place.

How to Mend Rubber Hose.

Mr. William Hunt, of New York City.—The inclosed method of mending rubber hose ought to be known to everybody. I mended mine in several places two or three years ago, and it is yet strong and good. The plumbers said there was no other way but to use couplings, costing a dollar each. I used iron pipe cut to order three inches long, costing three cents each. Cut the hose apart where it is defective, obtain from any gas-fitter a piece of iron pipe two or three inches long, tie the hose over it till the ends meet, wrap with strong twine well waxed, and it will last a long time.

Poultry Raising.

Mr. C. Noyes, of Lebanon, Conn., inclosed an account of what he had received from an average of thirty hens, each year, for the past five years. This amount, he said, is what I have sold, not taking into the calculation the eggs and poultry used in the family, consisting of seven persons. My practice is to kill the hens in the fall after they are one year old, and raise enough chickens to keep my number good. I think in this way we get more eggs, and the young fowls do less mischief than old ones. The fowls run at large except about two months in the summer, and then they are let out about two hours a day toward night. But here are the statistics: Amount received from thirty hens from April 1, 1864, to April 1, 1865, 269 dozen eggs, $73.10; 250 pounds poultry, $53.05—$126.15; average per hen, $4.20. April 1, 1865, to April 1, 1866, 252 dozen eggs, $79.50; 59½ pounds poultry, $18.11—$93.61; average per hen, $3.12. April 1, 1866, to April 1, 1867 (35 hens), 303 dozen eggs, $97.03; 134½ pounds poultry, $31.05—$128.08; average per hen, $3.66.

Notes of Southern Travel.

An English gentleman, Mr. Bower Wood, of Long Island City, has just returned from a journey in the South, and reports as follows:—We found throughout North Carolina and Virginia, every disposition to welcome immigration, to put aside politics, and an earnest wish to embrace every northern suggestion and improvement. The negroes are disappointed because they do not each get a forty-acre farm and a mule; but as a rule they are neither troublesome nor dangerous. In truth, they require the incentive of the master's eye, or else a faithfully-fulfilled contract by the piece or acre, just as white laborers do. Their wages vary from seven to ten dollars per month, and rations, which do not cost altogether more than ten dollars per month more. The females make excellent in-door servants, and can be hired at nearly half the above. We found all portions of the States above-named healthy, and with the advantage over the western sections of nearness to market, plenty of splendid timber, and good water. The heat we felt no more than in New York, and farmers assured us that they could do that hardest of all work, the hoeing of cotton, all day in the hottest sun. The quality of the land is various, but equal to any section north that we know of, and wherever proper cultivation, rotation of crops, and manures are applied, the results are in excess of northern products on the same area. Japan clover, white and red clover, and

the grasses generally, can be grown, while cotton at the present price, and the vineyards which are rapidly being inaugurated, render a farmer's success speedy and certain. The prices of lands vary from three to thirty dollars per acre. In the cities and towns large sized lots can be got from fifty dollars to $500. Houses and grounds which cost five times their present price can yet be readily obtained. Even in the mineral regions, real estate is still very cheap. We saw a large fruit farm, only four miles from Raleigh, rich in gold and plumbago, with good house and 180 acres, that could now be bought for $1,500. The owner was the former postmaster, and a much respected man. One-fourth cash, and three to five years' credit, are the general terms; while many properties can be hired, with an option of purchase, at a stated price agreed upon beforehand. Even mere laborers are readily welcomed, for their energy is much needed, and they form a check upon the negro, who, as the Rev. J. B. Smith of Raleigh remarked to us, has at present no proper standard by which to measure a day's work. Mechanics and artisans would find nice openings and be free from much of that wear and tear which characterizes the struggle for life in more inclement latitudes.

By taking a trip to Norfolk, Portsmouth, Richmond, Lynchburg, Weldon, Raleigh, and Asherville, the intending emigrant may readily satisfy himself as to which is the best spot on which to settle, according to his capacity and capital. We are assured that the present farms are too large for the means of the present holders. They will cheerfully part with a portion to enhance the value of the remainder and to secure a good neighbor. That this season will be a happy one for the south, we do fully believe. Some immigration and capital have already taken place; the full stream will soon follow. The present wheat crop is all safe, and the best known for many years. Oats and vegetables are more than an average crop, tobacco is fair, and, though the season is backward, cotton is generally in blossom and the yield at the present prices promises to be the most enriching of any that has occurred of late years. The south will soon be fully recuperated. Norfolk will soon be a busy entrepot worthy of its magnificent harbor, and Wilmington must have her share of direct intercourse. It ought to be the earnest and daily prayer and work of all good Americans to do all that in them lies, to help forward this intermixing and prosperous knitting together of all parts of our common country."

Century Plant.

Mr. E. A. Frost, of Rochester, New York, sends photographs of the American aloe, or century plant, now abloom upon his premises, and the subjoined interesting historical account of the singular flower: "The American aloe, or century plant, is a native of Mexico and South America, and has been introduced into some of the warmer parts of Europe and the United States, where it has been cultivated in green-houses. Accounts give us descriptions of the flowering of this majestic plant in several localities, among which may be mentioned one in Devonshire, England, which had a flower stem twenty-seven feet high, its branches being loaded with 16,000 blossoms; also one at Cornwall, England, which flowered in 1837, and had flowers of a sulphur yellow color, above five inches in length, to the number of 5,088. The flower buds appeared the last of June, and on the 21st July, there were thirteen lateral and alternate branches thrown out, at the extremity of which there were numerous clusters of flower buds, measuring from fourteen to eighteen inches across. On the 7th of September the flower stem was twenty-five feet high, and had thirty-four arms or branches, besides a cluster of flower buds on the top of the stem. By the middle of October the lowermost clusters were in great perfection, and remained in bloom until Christmas. From the 10th of October to the middle of November, the stately appearance of the plant, with its gracefully curved branches expanding like beautiful candelabra, and sustaining such a number of erect blossoms and buds, the flowers beautifully succeeding each other, presented to the eye a spectacle highly gratifying. As the flower-stalks grew and the flowers expanded, it seemed to exhaust the plant, and the leaves drooped and rapidly withered, but the stalk remained green and took several months to get dry. The century plant now about to flower on my premises, is the *Agav Americana folia variegata*, or striped-leaved American aloe. It is now about seventy years old, and was purchased by the late Hon. John Greig, of Canandaigua, New York, in the year 1809, from Prince's Garden, Flushing, Long Island, and at that time was supposed to be nine or ten years old. On the 25th of April last, indications of its flowering were observed, and its daily advance is carefully noted."

A Show of Black Caps.

Mr. A. S. Fuller exhibited several plates of this fruit, which has just replaced the strawberry. Lum's Everbearing was very large and

was described as yielding all summer. But it will not answer for market for the reason that it has too much bloom. Bloom, in the estimation of the commissionman, is a good thing for a cluster of grapes, but a bad thing for a basket of black caps. Summit yellow is a new variety, not previously exhibited before the Club. As its name indicates, it is yellow in color, but it is of the black cap species, and, though perfectly hardy, will not do for market, because yellow is not a desirable tint. A blackberry had better be either decidedly sable or red. The old favorite Doolittle has not yet been eclipsed.

THE WESTCHESTER BLACK CAP.

Mr. Thomas Cavanagh, chairman of a committee appointed to examine the new seedling, submitted the subjoined report:

The Westchester black cap rasberry is a chance seedling, which originated eight years since in the yard of Levi J. Mabie, of Tarrytown, New York. He has cultivated the plant since that time for the better opportunity of testing and fully demonstrating its value; it is one of the strongest growing varieties we have seen, having ample opportunity of contrasting it side by side with the Doolittle. In various situations and on different soils we found it exceeded the Doolittle in every respect. Canes that we measured were from fifteen to eighteen feet in length, and bearing 150 trusses of berries. These canes would certainly produce two quarts of fruit at a picking. Another bush we saw, grown entirely from one stem, was so productive that, although three quarts of ripe fruit were picked from it, nearly eight more were just ripening. We were satisfied that no extra care or cultivation had been given, the plants being grown close to a picket-fence, and the canes never having been pruned; they were all of the same size and productiveness. In comparison with the Doolittle, it is more productive and one week earlier; the berries are as large, if not larger, than the Doolittle, and in flavor far superior, flesh firm, seeds small, and on this account making it desirable for preserving. It ripens more uniformly and produces less imperfect fruit. There is no doubt about its being a distinct variety, and in our opinion a desirable acquisition to our list of small fruits, either for market or family use.

REPORT ON THE NEW GRASS SEED CLEANER.

The committee consisting of Messrs. S. E. Todd and J. B. Lyman, appointed to examine the new grass seed cleaner which was brought

before the Club by Isaac Baldwin, of Antrim, N. H., report that they supervised the operation of this cleaner at R. H. Allen's seed store; and they do not hesitate to pronounce it one of the most efficient labor-saving machines in the line of farm implements that they have ever met with. The principal parts of this machine which are worthy of description, consist of a sieve about six feet long and two feet wide made of perforated zinc. The size of the holes in each sieve is made to correspond to the size of the kernels of seed that are to be sifted. When the machine is in operation, the sieve has two motions, a reciprocating movement endways, and at the same time, a kind of half-rotary oscillating motion. Near the center of the sieve, it rests on a pivot, so that the ends can play right and left, as the sieve is worked back and forth by means of a crank which makes several hundred revolutions per minute. This oscillating movement of the ends of the sieve constitutes the great excellence of the machine. Working a sieve either back and forth, or to the right and left, is an old and familiar device, which every philosopher and mechanic understands quite satisfactorily. But the oscillating movement of the ends at the same time of the reciprocating motion, secures an efficiency in the operation of sifting seeds which has long been needed, but which has never before been put into practical operation.

Every intelligent farmer who has had practical experience in cleaning seed as red top, Kentucky blue grass, L. I. blue grass, and the *dactylis glomerata*, each of which will weigh only twelve to fourteen pounds per bushel, understands the great labor of sifting such light seed, which has heretofore been done by hand at a great expenditure of manual labor. But this comparatively cheap cleaner will enable a boy and one man to clean more seed in a given time, than could be passed through sieves in the old way by ten or more faithful men. The invention is not a patent. The only wonder is, that some ingenious Yankee has not thought of this device long ago.

Ice House and Preservatory.

Mr. J. M. M. Gernerd, Muncy, Lycoming county, Penn.—Will the Club please give me a full description of the best method for constructing an ice house and preservatory. Is it true that the more perishable fruits, as strawberries, cherries, grapes, peaches, lemons and oranges, are kept in this manner the year round without a sensible deterioration in flavor? I am not aware that there is any arrangement of this kind in this section of the State.

Mr. J. B. Lyman.—There is no method by which the more perishable small fruits, as strawberries and cherries, are kept more than two or three months. But pears of delicate flavor, as the Dutchess, keep in the houses constructed by Professor Nyce, for four or five months. He seeks three conditions: 1. A temperature of thirty-four degrees; 2. Exclusion of air; 3. An absorbent of moisture. The latter he finds of as much importance as either of the others. The atmosphere must be cold, uniform and dry. The patent of Prof. Nyce does not, of course, prevent any one from constructing a tight ice-house. His patent rests mainly on the substance with which he keeps the air dry.

Mr. Gernerd may keep fruit a very long time by building his ice-house as follows: On a side-hill, so as to secure perfect drainage; put the ice in on the upper side; have the floor of rough cobbles, with drain tile beneath. Make it large, say twenty-five by twenty-five, and in the middle build of brick, laid with hydraulic cement, with arched roof, a chamber ten by ten. Have the floor a little convex, with holes to take away the water on each side, these holes to be guarded on account of rats. The door should be thick, with an inner door of thick felting, stuffed with sawdust. For an absorbent, use fine dry charcoal. If the charcoal gets wet, take it out and dry it. Fill the chamber with sets of perforated shelves, and on these lay the fruit, taking care not to bruise it in any way. It is important not to open the door so as to communicate with the outer air. A quantity of fruit throws out an atmosphere in which carbonic acid gas abounds, and this it is which preserves the fruit. By creating some of this gas and forcing it in, the process would be more effective. The Gamgee meat-preserving process is essentially little more than this which we have described.

Evergreen Seeds.

George Stoolfire, of Sugargrove, Warren county, Pennsylvania, asked information as to the proper time to gather the seed of tamarack and balsam, and when to plant.

Mr. A. S. Fuller.—The seed should be harvested as soon as it is thoroughly ripened. I prefer to keep it until spring, and then sow it in some shady place. The reason novices fail in their attempts to raise evergreens is, they do not guard the young plant from the sun. Nurserymen use canvas. A screen of lath serves a good purpose. If the plant can be brought through the earlier stages, there is comparatively little trouble.

Tansy for the Borer.

Mr. W. A. Scott.—I was looking through a neighbor's orchard, a few days ago, and noticed tansy growing around the roots of most of his apple trees. On asking his object, he told me that it was to keep the borers away. We examined the orchard carefully, and not a borer nor a borer's mark was to be seen in the trees where the tansy was growing. The trees without tansy were more or less affected, and some of them almost ruined by the borers. He will put tansy roots around all of them next spring. He told me of another neighbor who had learned this idea of him, and to that neighbor I went. The latter told me that before he put tansy around his trees the borers were very troublesome, but that since then he had never seen a borer. I do not think the tansy hurts the growth of the tree, for those with tansy around were undoubtedly the finest looking trees. What does the Club think of this? It's new to me, is it to you? or is it merely and old fancy rejuvenated?

Mr. A. S. Fuller.—It is by no manner of means a new thing under the sun. It swings around the circle once every five or six years. In my opinion it clutters the ground about the roots, and takes succulence from the soil which the tree cannot conveniently spare. No farmer wants so much tansy growing about his house, and a good sharp wire, well used, will finish the borer at less cost.

The Chairman.—The remedy, if a remedy, is inexpensive, at least.

Is Pie-plant Poisonous?

Mr. S. S. Gregory, Berea, Ohio.—At one time the opinion was held by some that pie-plant, as now used by many, is an unsafe article of diet. Two cases of poisoning by eating the leaves of it have come to my knowledge recently. In Pennsylvania nine hogs of the Chester county breed, had such leaves fed to them; five of them died in consequence. In Indiana a family of five persons ate of such leaves boiled for greens. All were made sick, and one of them died. If the leaves of a plant *are* poisonous, is there room for doubt that the stalk on which such leaves grow is also poisonous? Can experiments be tried to settle this question conclusively?

Mr. D. B. Bruen.—We know that there is prussic acid in pie-plant, and that this is poisonous. Peach leaves have it, and the fruit also.

Mr. A. S. Fuller.—But you take this acid out of peaches and you spoil them. As regards the question asked of our correspondent, there is no doubt that it is perfectly safe to eat pie-plant. Oxalic

acid was supposed to be found in the juice, but this statement has been questioned by authorities. Our Professor, Johnson, says no. A man may hurt himself by eating blackberries; I have. So are peaches liable to make one sick. Pie-plant is as safe as anything else.

Dr. Isaac P. Trimble.—Any student of materia medica knows there are certain plants of which parts are poisonous and other parts valuable. I have no doubt that the leaf of the pie-plant is poisonous, however safe the stalk may be decided to be.

Dr. J. V. C. Smith.—I believe the functions of leaves and stems are very different. But if the leaves of the pie-plant had been cooked for the swine, I apprehend there would have been no trouble.

Prof. James A. Whitney.—There can be no doubt that the leaves of pie-plant are poisonous. There is oxalic acid in them, and any one who uses them will run the risk of uncomfortable consequences. As regards the pulp, long experience has proved that there is no danger from that.

Mr. P. T. Quinn.—I send to market some 15,000 bunches of pie-plant per annum. During the past twelve years the demand has increased 1,400 per cent. Still I have never heard of ill effects from its use. We throw the rubbish in the manure-shed and not in the pig pen.

ON THINNING PEARS.

Mr. P. T. Quinn spoke briefly in advocacy of the great advantage of lessening the weight of over-burdened branches. He said: It has often been remarked that he is a benefactor who causes two blades to grow where one grew before. The other day, in the State of Camden and Amboy, a gentleman avowed his conviction that he is a benefactor who puts three railroads where before were two. In pear culture, if you leave two where before there were three, you consult your own interest. By doing this you give the two a chance to mature, and there is always a demand for first quality pears, while commoner specimens are always a drug in the market. It is to the advantage of all, both producers and consumers, that only those be left which are likely to come up to the standard.

The Chairman.—The difficulty is, people can't bear to remove fair looking fruit. It was ten years before I could screw my courage up to do it, yet all the while I appreciated the advantage.

Mr. A. S. Fuller.—The same is true with pruning. A husbandman hesitates to put the knife among the branches.

Mr. D. B. Bruen.—A tree very full of fruit becomes exhausted as a man with overwork, and, unlike him, does not rally.

Draining.

Mr. W. G. Roberts, Racine, Wisconsin.—Will the Club be so kind as to help a brother farmer out of trouble. I am green at the job of draining except what I read in Mr. Waring's work on "Draining for Profit and Health," a book indeed every farmer ought to have. I am now ready to lay about 3,000 tiles, the ditch finished in good order as far as the *incline* is perfect, for I have enough water to follow me from the upper end. This ditch of mine goes through several wet patches, and my main object is to dry up those low spots in my plow-fields.

Now for the question. Is it absolutely necessary that the tiles should be put below the frost everywhere? In some of those low spots I could not go over eighteen inches deep; in some of my wet spots, without losing my fall to the water, and after I had everything ready, it occurred to my mind, after I had finished my ditch, whether or no if the frost would disorganize the laying of the tiles and remove them out of their fixed locality. I have examined Mr. Waring on this subject, but find no direct information on this point. I must stop laying and filling up the ditch till I hear from you.

Mr. Geo. E. Waring.—Under the circumstances you describe I would not hesitate to lay the drain eighteen inches deep. If the water flows through the tiles in winter they will not freeze, as the water of the lower soil is quite warm. If the locality of the pipes freezes I think it will all run alike, and will settle back to the correct grade. If you could use collars, even if only strips of old tin or iron, they would make a sure thing of it.

A Perpetual Lime Kiln.

Mr. R. Warren Towle, Jacksonville, Fla.—Will some member of the Club who has had opportunities for observation give some account of the arrangements when lime burning is made a business.

Mr. J. B. Lyman.—The shape of the kiln on the inside is that of an egg with the little end down. The drawing in at the top is done to retain the heat. If the ground is level a building on an elevated drive way is necessary for conveying the coal, and the lime or shells to the mouth of the kiln. If there is a hill its slope gives an advantage and saves much work. When stone is abundant a good kiln can be put up for $100. The opening at the bottom is not large.

When complete wood is laid crosswise in the bottom, on it are thrown the chunks of lime rock, then coal or wood, then a layer of the lime rock or shells, then fuel enough to cover, and so on in alternate layers. The top must be protected from the rain. Twenty-four hours is enough for burning out the first kiln; the powdered lime is removed by opening a slide or door at the bottom. All is not removed, but the empty space above filled with fuel and unburnt lime as before. No written directions can be given that will supply the need of an experienced man; for one lime burner will use a third less fuel than another and do as much work. Lime rock differs a good deal in toughness, so that no precise directions will suit all cases.

Adjourned.

July 13, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Grasshoppers.

Mr. W. W. Rumford, Tule, Tulare county, Cal.—I have discovered a remedy against the grasshopper that so far seems perfect for the protection of trees. Train them up four or five feet from the ground, then put a disk of smooth tin, funnel shaped, just beneath the lowest branch, large and downward. If the bark of the trunk is tender protect with matting. The grasshopper does not jump high, but crawls up the tree or stalk of a plant. In this way they will go to the top of a telegraph pole. I also have some small trees protected by gauze netting. They rarely injure early sown grain, as it is too near ripe before their advent. I have three trees with heads only twenty inches from the ground, protected by the tin discs, and so far they are safe. although the ground around is alive with the passing horde. I have sat by the hour to see them climb up to the tin, and then climb down again.

The New Textile Ramie

Mr. W. F. Kernan, Clinton La., sent a piece of ramie plant, and wished to repeat Bulwer's question. What will he do with it? In his vicinity, he says, it grows readily, and its cultivation requires little labor.

Mr. Solon Robinson.—The culture of this textile is being commenced all over the south. Our correspondent's interrogation is an important one, and ought not to be carelessly answered. I suggest that

the subject be referred to a committee who will give it the consideration its merits demand.

This suggestion was acted upon, and Messrs. Lyman, Gregory, and Robinson were named as the committee. It may be mentioned in this connection that a lady present, Mrs. Devlin, showed a parasol covered with this material, thus affording evidence that it may be made to answer some good purpose. The cloth made from ramie has the cool, clear look of the best linen and the luster of silk.

Fish Breeding.

Mr. Wm. Ellis, of Princeton, Burran county, Ill., wrote in regard to the propagation of trout, and desired especially to know if they would be likely to thrive well in "the sucker State." I have, he says, on my place a clear, cool, never-failing spring creek, running rapidly over a pebbly bottom, through a grove of maple, elm, ash, basswood, etc., and could readily construct artificial ponds of one-quarter acre to two acres in extent. I have neighbors with equally good facilities who would occasionally like to indulge in a breakfast of "speckled beauties" such as we used to take from the mountain streams of northern Pennsylvania and southern New York. But will they grow in the "hard" water of this region? Who knows? If you can instruct us, O, ye wise men of Gotham! to add trout to the many bounties afforded us by the prolific soil of this beautiful part of our country, then shall we be able to send you more pork and be less "hoggish" ourselves.

Mr. A. S. Fuller.—There is a gentleman, formerly of Ridgewood, New Jersey, but now residing on Long Island, Dr. John M. Crowell, who has had large practical experience in this business, which business, by the way, is destined to become a very important one. He has raised twenty thousand trout this season in a little race course. I doubt not he will be glad to furnish our western friend with the facts he pines for. This plan of raising trout may fail, not for want of water clear enough, but cool enough. Yet, if he cannot breed trout, there are such sorts as perch, dace and pike that he can have in great abundance in his waters.

Blackberries.

Mr. G. L. Baldwin, Guiney's Station, Caroline county, Virginia, would know what to do with the thousands of bushels of blackberries which grow wild and run to waste each year in that part of the Old Dominion. "If wine-making be advisable, give me a recipe, with

full process; also, information concerning the sale of it, where, and for how much per barrel, and if whisky barrels will do for putting it in?"

Mr. A. S. Fuller.—I think he would find it to his advantage to dry them. If he should make them into brandy he would be lending assistance to a cause to which he might not care to lend assistance. In the New York market next winter they will bring from forty cents to seventy-five cents per pound. Kiln-drying is the best process, but we must expect a four-fold shrinkage. I have often had crops of blackberries that I would not put in the market which I sold at a fair profit when dried. The crop is large everywhere, and we should be glad if some lady who makes a prime article of blackberry cordial would forward us her recipe.

DRAINING.

Mr. James Sackett, of Avon, N. Y.—I see, by reports of the 6th instant, a communication from W. G. Roberts, asking about laying tiles eighteen inches deep, and he was advised to lay them. I have been putting in drains made of two boards, six inches wide and six or eight feet long, leveled off and nailed together on one edge, and spread apart four inches at the other, laid on a piece of board a foot long at the joints where the bottom of a ditch is hard, and whole length where it is soft; have used oak and hemlock. The cost of hemlock is not more than clay tile. I took up an old drain last summer that had played out three or four years ago; was put down twelve years ago, two and one-half feet deep; tile were all crumbled to pieces and rotten, and the boards under the tile looked as good as when put down. Have streams running through the board tiles that will more than fill a two-inch clay tile.

Mr. Solon Robinson.—There are drains of the kind described at the insane asylum at Utica, three and a half feet deep, which were put down more than thirty years ago. That is a deep clay soil. Of course, in sandy soil it would be necessary to go, say, five feet down, in order to make them last as well.

Mr. G. Roberts, Racine, Wis.—I shall be very much obliged if the Club will inform me and others if tile, properly burned and made of proper clay, is subject to crumble and decay. I am using Milwaukie tile.

Prof. James A. Whitney says, in answer.—The best admixture of clay and sand for making a perfect tile is not easy to hit upon. A tile should be somewhat porous, and also tough. Those of a bright

red color, like the best Baltimore brick, are in this part of the country, found the best. They should have considerable iron blended with the sand to give toughness. The color of the clay near Milwaukie is entirely different from that commonly used, and is illustrated by the handsome cream color seen in the buildings of that city. The best rule is to get hold of a tile that you know to be first class, break it, and observe its texture; then buy those only which resemble it. A little observation will make any farmer a good judge.

Malleable Iron.

Mr. D. B. Bruen showed several parts of farm implements made of malleable iron, and he took occasion to allude to the inventor, Mr. Seth Boyden, of Newark, N. J. Malleable iron takes the place of wrought iron; it is bent when cold. Probably not one reaping machine would be used where there is now thirty were it not for this invention. Malleable iron enters into the construction of a thousand more things than any one has an idea of. I know scarcely an article of household use into which it does not enter. In Newark, millions of dollars are added to the annual trade in consequence of this invention; and yet the inventor has realized little or nothing from his discovery.

The Garden Cultivator.

Mr. J. B. Lyman.—Mr. Chairman, Messrs. Blymyer, Day & Co., Mansfield, Ohio, have sent us this implement. In some of my travels I saw one, and after using it awhile, in a corn-field, thought it might be a great improvement. Some months since, you may recollect that Mr. Horace Greeley spoke of the importance of devising means for making garden culture less laborious and costly. If this is really an advance in that direction we ought to hail it as such. It consists, as you see, of two wheels running one behind the other in a beam three or four inches square, to which handles are attached. Midway between the wheels these tools are fastened; here is a plow, here a bull-tongue cultivator; this is a rake for collecting the weeds in piles, and here we have a scuffle-hoe, running an inch under the surface and cutting weeds and grass, and here is a bayonet-plow for breaking up tough, baked surfaces; and this circular disk, with sharp edge, is used for cutting off the runners of strawberries.

Mr. Solon Robinson.—The question is, whether the labor of pushing that tool is not as great as using the common hoe and rake. Do you think a real gain is brought by such devices?

Mr. J. B. Lyman.—That is just what we want to know, and we can find out only by a number of trials on different soils and crops.

The Chairman.—If Mr. Lyman will be one of a committee and Mr. Quinn another, I am sure the invention will be well tested.

Mr. Solon Robinson.—It should be used not only by men with brains but by common, bungling fellows, such as we have to depend upon for day labor, in order to find out whether it will generally reduce the amount and severity of garden work.

HAY-MAKING.

The regular paper of the day was read by Mr. S. Edwards Todd, as follows:

The process of making hay consists in evaporating the moisture from the juices of the grass, which, if not driven out of the stems and leaves, would sooner or later heat in the mow, and thus injure the hay. When apples, pears, peaches, or any other fruit is dried, the object is simply to evaporate the moisture, which would hasten the decay of the fruit. If we spread a small quantity of green grass on a floor beneath a roof that will protect it from rain and dew, the moisture will disappear in a few days, and the leaves and stems will be as sweet as grass to the taste of the animal, and it will emit an agreeable fragrance, and no smell of must or dust will be perceived when the hay is moved. These facts furnish an important clue to the process of making hay. We often hear it said that farmers should make hay while the sun shines, which is a sound precept. But it is quite as important to understand how to make hay in cloudy weather as when the scorching sunbeams are poured upon the meadows like the heat of a vast furnace. There is quite as much danger of injuring the quality of hay by allowing the grass to be cured too much in the burning sun as there is of baking bread, or pies, or cakes too much. Suppose, for example, that our domestics were to leave the bread, pies, and cake in the oven for two or more hours after everything had been thoroughly baked. A loaf or a pie would weigh about the same, after having been heated and dried for several hours after the baking is finished, as such things would weigh when baked just enough to taste the best. But who likes double-baked, scorched, and dried-up bread?

Now, then, if grass be allowed to lie for hours, and in many instances for two or three days, exposed to the hot sun, the hay will appear quite as unpalatable to domestic animals as scorched and dried-up

bread does to us. Cattle will eat such inferior hay rather than starve. And so people will subsist on scorched and dried-up bread. But do they eat it with a relish? The substances in the newly mown grass are in a semi-fluid and plastic condition. The object in making hay is to dry these substances just enough to prevent their spoiling in the mow, and at the same time retain a kind of elasticity. When the stems and leaves of grass will break and crumble to atoms, the evidence is conclusive that the hay has been sunned too much. When grass is spread out in the burning sun, as soon as the stems and leaves on the surface have become wilted, the tedder and the forks should be put in motion, and the newly mown hay should be tossed about continually until every leaf and stem is fit to be raked. By stirring and turning and tedding, other stems and leaves are brought to the surface, where they receive the benefit of the heat of the sun. Besides this, grass will cure in the air much sooner than when lying on the ground. Could machinery be devised for keeping grass whirling and flying about in the air, the hay would be ready for the barn much sooner than if allowed to lie until the stems and leaves on the surface are as dry as burnt pie-crust.

When we deposit new wheat, Indian corn, or grain of any kind in the granary, why are we always so careful to have every kernel sufficiently dry to prevent heating? When dried apples are packed in a hogshead, why is it essential that every piece should be dry before they are packed? When we gather mint, sage, and elderberries, why are we always so careful in drying such things, to avoid any spontaneous heat? Simply because spontaneous heat, after the moisture has been expelled, will leave a musty taste and a moldy appearance. We say, and truthfully too, that by heating and sweating in a body, such substances are injured in proportion to the degree of heat. But, strange to say, many intelligent farmers will insist that it is a good way to cure grass by putting it into a tight barn, tread it down tight in the mow, and let the redundant moisture be expelled by spontaneous heat. It injures hay just as much to heat and sweat in the mow or stack, as it does grain to heat in the bin. I know this is so, and I can convince any intelligent person that I am correct, and that the process of heating and sweating is very injurious to the hay. In order to test this opinion, let a load of green grass be spread around in a barn, say two feet thick, without being pressed down. Occasionally let it be turned over, until every part is thoroughly dry. Then let this hay be compared with other mow-burnt, musty, dusty,

and moldy hay that has been allowed to sweat and heat and reek, while being cured, like a Thomsonian steam-box, and I will guarantee that the notions about drying and curing hay by sweating will be cherished no longer.

A Quince Orchard.

Mr. A. J. Stirling, of Rochester, N. Y., "has made arrangements to set four acres of this fruit, and would like replies to the subjoined interrogations: "Are there two or more kinds, and if so, which is best for bearing and market? Second, how far apart should they be set both ways? Third, what kind of soil is most suitable?

Mr. A. S. Fuller.—If we may credit the ancient chroniclers, quinces have been cultivated 2,000 or 3,000 years. Of course, an immense number of seedlings has been originated during that time, and the names have become so complicated that it is exceedingly difficult to say which is best. For instance, the sort known to nurserymen as the Portugal is not valued at all, and yet I have heard some cultivators speak of it in the highest terms. Of course, the quince they were thinking of was not the quince the nurserymen were talking of. A heavy, moist, tenacious soil is the most desirable; along the bank of a stream is an excellent location, and muck or peat is the best manure. The Angiers quince will probably outbear the other varieties. It is doubtful whether four acres in quinces would pay. They should be plated in muck meadows and beside ditches.

Dr. Isaac P. Trimble.—I remember that ten or fifteen years ago a great number of quince bushes were planted in the vicinity of Newark, but they did not succeed at all well. The remains of the orchards are there yet. The trouble was, the apple-tree borer got at the roots underground, and, unsuspected, silently he worked the devastation. I don't advise the writer of the letter to plant quinces so extensively as he has planned, but if he persists in doing so, by all means let him not neglect to be careful in selecting his stock, examine each root carefully, and be sure that he does not plant the quince root and its enemy together.

Farming in Virginia.

Messrs. S. C. and R. Denise, of Norfolk, Va., sends some large, fine looking potatoes, the early rose. From four bushels of seed they have taken a yield of sixty-five barrels; planted on the 12th of March, dug 12th of June. They find the rose ten days earlier than

any of seven early varieties. They have twenty acres set in Wilson's early blackberry.

Liniment for Stock.

Mr. Henry Adolph, Clinton, Douglas county, Kan., sends a bottle of liniment for external diseases of sheep, horses, and neat cattle, which he wishes the members to test.

Adjourned.

July 20, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Commercial Fertilizers.

Alfred L. B. Zerdgo, of Alere, Loudon county, Va., wrote as follows: "I am manuring a small piece of meadow land—say two and a quarter acres—with about 150 ox-cart loads of stable manure, and I intend plowing it up this fall. In the spring I propose to plant corn on this field, and I want to use some poudrette of the Lodi Manufacturing Company with the corn. I should like to hear from members of the Club, their experience with poudrette; how to use it and how much to the acre."

Mr. J. B. Lyman.—Good commercial manure will give a quick growth in May and June, when applied to Indian corn; but I do not think the ears will be any larger. After a good many experiments I have come to the conclusion that no fertilizer begins to compare with ground bone. Those advertised mixtures are valuable in proportion as bone is made an ingredient. The Lodi company makes several varieties of commerical manure. The cheapest is New York filth, dried. Another sort is this dried filth, mixed with the offal of slaughter-houses. Still another has in it a good deal of crushed bone. I have tried the Lodi poudrette, and must say that its effect on grain and potatoes has, to some extent, disappointed me. It does not appear to be a lasting manure. This kind of commercial fertilizer, which is known as poudrette, does not seem to have any available ammonia in it. Another season I think I shall employ bone manure instead of poudrette.

Mr. D. B. Bruen.—My experience coincides with that of Mr. Lyman in regard to poudrette. So I employed bone dust. But this killed my strawberries. Perhaps we applied too large a quantity to a hill.

Mr. H. T. Williams.—I applied bone dust to tomatoes and found it advanced their ripening full two weeks. But I do not con-

sider poudrette worth $1.50 or two dollars per barrel. I used bone-meal upon strawberries, and found it the best manure obtainable for that crop. It is particularly good on sandy soils; on heavier land stable manure must be esteemed as much more valuable, and, in fact, unsurpassed. We usually spread about half a gill around each hill, and hoe it into the soil. I never apprehended any danger arising from the source alluded to by Mr. Bruen.

The Hempstead Plains.

The Chairman called attention to the fact that a well-known merchant prince, Mr. A. T. Stewart, has just become a sidewalk farmer. He had gone out to Long Island and bought a little patch there which he proposes to improve. The Chairman then asked Dr. E. F. Peck to make some remaks appropriate to the occasion. Dr. E. F. Peck gave the following account of the past history of the Plains:

The town of Hempstead is one of the oldest English towns on Long Island, having been settled more than 200 years. The old village is on the southern borders of the "great plains," and about twenty-three miles from New York and these lands, purchased by Mr. Stewart are adjoining and north of the village, and are what is or was known as the Hempstead plains, or "barrens," or common lands, as it was owned by the town, and could not be sold without a vote of the town, which could never be had until very recently, the land being used as a great pasture ground. Everybody in the town had the right to turn their cattle and sheep upon it, and where innumerable herds have fed and flourished for more than 200 years, and where the grass never fails to grow. Yet in the face of this great fact, this perpetual evidence of the productive power of the land, a strange and singular belief prevailed among the inhabitants of the town and the island, and upon their authority, among "all the rest of mankind," that this great tract of land was *barren* and *worthless* for culture. There never was a greater popular fallacy and error. It is, in fact, a great prairie, a great and most beautiful upland meadow; nothing more, nothing less. It is really one of the most beautiful and valuable tracts of meadow or garden land in the State of New York, and Mr. Stewart's purchase of this great tract will dispel the strange and stupid delusion and folly, that have so long hung over the "great Hempstead cow-pasture." A very fortunate town is Hempstead, to have its common lands or pasture ground turned into nearly half a million of money; for Mr. Stewart's purchase

of over 8,000 acres at fifty-five dollars an acre, for which he pays cash, amounts to over $400,000. What other country town in the the State of New York has such a property; such an inheritance?

A very great misapprehension in the public mind prevails, in regard to the "great Hempstead plains." The strangest things imaginable have been said about it and against it, about its barrenness; "a great dreary waste," none of which are true. It is not a great "dead level." As before remarked, it is a great and beautiful upland meadow; the summit level or most elevated part on the northern borders of the "plains" is more than 150 feet above tide water, distant about seven miles, to the south side of the island. Thus it will be seen that it is a great elevated table land, having a southern aspect or slope of about twenty feet to the mile, just enough to make the most perfect drainage. The entire surface is gently and beautifully undulating, so that in passing over the "plains" from west to east, you pass over a succession of gentle elevations and depressions, running northwardly and southwardly; they are so gentle and gradual, with few exceptions, that they are almost imperceptible. These valleys or depressions, have the appearance of the dried bed of streams or water courses, meandering off through the "plains" southerly toward the ocean shore; and near by at the southern edge of the plains they nearly all contain springs of the most pure and living water, which soon swell into the "brooks and rivulets," so beautifully described by an old author, "which empty themselves into the sea on the south side of Long Island." This old author says: "Yea, you shall scarce travel a mile but you shall meet with one of them whose crystal streams run so swift that they purge themselves of such stinking mud and filth, which the standing or low paced streams of most brooks and rivers westward of this colony (L. I.) leave lying, and are by the sun's exhalation dissipated, the air corrupted, and many fevers and other distempers occasioned, not incident to this colony (Long Island Colony). Neither do the brooks and rivulets premised, give way to the frosts in winter or drought in summer, but keep their course throughout the year." Such is a description of the beautiful streams which arise along the southern borders of Hempstead plains.

The same old author (Denton's History, published 200 years ago,) says: "Towards the middle of Long Island lyeth a plain, sixteen miles long and four broad, upon which plain grows very fine grass, that makes exceeding good hay, and is very good pasture for

sheep and other cattle; where you shall find neither stick nor stone, to hinder the horse heels, or endanger them in their races, and once a year the best horses in the island are brought hither to try their swiftness, and the swiftest rewarded with a silver cup, two being annually procured for that purpose. There are two or three other small plains of about a mile square, which are no small benefit to those towns which enjoy them."

Such is the description given 200 years ago of the "great Hempstead plains." It was not then considered barren and worthless, for no barren land will produce "very fine grass, that makes exceeding good hay, and is very good pasture for sheep and other cattle."

This tract was then described as being sixteen miles long and four miles broad, which would make sixty-four square miles, over 40,000 acres of this great upland meadow. Other old writers described it as being much larger; it has all disappeared by the encroachments of settlement and cultivation into and around its borders, till only some 8,000 or 10,000 acres of it remained, which Mr. Stewart has purchased, and the whole of the dreaded and despised plains will soon disappear, and be only known by history and tradition; indeed, the extent and limits of the original plains have long been subject of dispute and uncertainty; there is probably no man living who knows the lines and extent of this great prairie of Long Island, as it existed at the time of the settlement of the town of Hempstead, in the year 1641, nor any records in existence, by which the exact extent or limits of the "plains," can be defined. The township of Hempstead was very large; it extended across the island from north to south. It was divided in 1784, North Hempstead having then been set off, as a town, leaving to Hempstead about 100 square miles or 64,000 acres. The town of Hempstead is reported in Mr. Primes History of Long Island, published in 1845, as containing 29,501 acres of improved land, and 42,499 acres of unimproved land.

The town of North Hempstead, by the same authority, is reported in 1845, to contain 29,708 acres of improved land, and 4,782 acres of unimproved land.

This statement presents the remarkable fact, that Hempstead in 1845, contained 42,499 acres of unimproved land within twenty or twenty-five miles of the city of New York. A portion of this unimproved land is undoubtedly marsh land, but what portion is not stated, a large part of it is upland and capable of the easiest and

highest cultivation. The soil of all this great region is the very best and finest garden soil.

Dr. Peck, further said, he never owned any land of the Hempstead plains, nor never had any pecuniary interest in any land in the town of Hempstead; but that he had, for more than twenty-five years past, advocated and urged the sale and cultivation of these lands, as a great public good.

The Chairman.—I look upon Mr. Stewart's enterprise as the opening of a new era for Long Island, and for many people in New York as well. Mr. Stewart is a more liberal man by far than he has credit for, and I feel sure he will do an excellent thing for the masses.

Mr. A. M. Powell.—I have no doubt that Long Island lands are valuable. They have been too long overlooked by farmers, and especially by persons in populous city pent, who sigh for cheap houses in the open country.

Mr. John Harold, Secretary of the Queens County Agricultural Society, forwarded a small box containing a portion of the Hempstead plains, one spade in depth, "so that the members might see for themselves what constitutes the long-neglected and miscalled Long Island barren lands, and the lands which A. T. Stewart intends shall blossom as the rose." The specimen was eighteen inches in thickness, and looked like a rich, mellow mold, free of stones, and well adapted to all agricultural uses.

Mr. A. S. Fuller.—I believe this is most valuable, because I have known it to be sold extensively in the New York market for guano. People paid for guano and were buying Long Island dirt.

Dr. E. F. Peck.—I would like to have the gentlemen present examine the soil sent. It is a fair show or specimen of the soil of the 10,000 acres in question.

Dr. Isaac P. Trimble.—I am informed that the Squankum Company have a scheme in view for sending this famous fertilizer to the region in question. They will, if they have the privilege, regenerate the waste places. Only yesterday I heard of a man who went from Monmouth county to Port Jefferson on the Island, and continued there the good practice of using marl. Of course he found it most valuable, and he has recently ordered a third cargo.

Egg Plant—How Cooked.

Mr. Lem. Lewis, Jackson, Adair county, Iowa.—I would like a little information from the Club, how to use the fruit of the egg plant;

whether we are to eat green or ripe, and how it is cooked, for I cannot find any one out here in western Iowa that knows anything about the plant. I have got sixty nice plants, and I will be very grateful if the Club will give me the information sought.

Mr. J. B. Lyman.—When the plants are deep purple, and a little soft, peel off the dark skin and slice, dip in a batter of egg thickened with flour, and fry slowly in butter or lard; or, boil till soft, mash fine, and mix with batter, and cook like griddle cakes; or, parboil, and cut in slices, and fry, seasoning to taste. When fixed up as it should be it makes a dish fit for Napoleon the little or any other king; besides, it is very nutritious, but unless cooked enough it tastes as raw and flat as a green squash.

BEET SUGAR.

Mr. J. S. Perkins, Breckenridge, Mo.—We want a little light on the beet sugar question. Do they soak or grind the roots before pressing? Does the syrup granulate readily? Come, who can give us a little light upon a subject of vast importance to the agricultural wealth of the country? It seems that this subject has been greatly neglected or underrated.

Mr. J. B. Lyman.—I am glad to see signs of life on this question. There is a great future for that root in America. The men who raise the roots do not make it up into sugar. That is a separate business. The farmer cuts and dries the beets, then sends them to a sugar-house and gets paid by the ton. The factory soaks them and works over the pulp, extracting the sweet and giving back the pumace. This is worth about as much for stock as the whole root. In beet sugar regions the cattle grow fat, the land grows fertile, and the farmers become rich.

BUTTER.

Prof. James A. Whitney.—Good butter is one of the products of high civilization. Half civilized nations have used it only as a luxury, and savage tribes cannot make at all. It has become one of the most important among agricultural products, and an essential adjunct of nutritious food for all classes in enlightened countries. Like other articles thus in general use it is a subject of interest in many ways; from scientific stand-point—for the manufacture of butter is directly dependent not only upon chemical reactions, but upon those physiological principles that control the health of the animals from whose secretions it is primarily derived; in its connection with mechanics—

for the separation of the butter globules from the surrounding fluid is accomplished by mechanical means; and more than all as concerns the agriculturist in its commercial aspects, for by the profits of its sale farms are bought and barns and dwellings built upon them. The bearings of chemical knowledge upon the processes of butter-making, of mechanical appliances upon its operations, and of the customs and practices of butter-makers and dealers with regard to the value of the article is the subject-matter of the present paper.

No dairyman need be told that the source of all good butter lies in good milk, and this carries us still further back to the herbage of green pastures and the water of shaded streams. For the purposes of the dairy the cow may be considered simple as a machine for transmuting succulent forage into milk. It is plain that the quantity and quality of the milk must be in proportion to the quantity and quality of the materials from which it is derived. Hence, when feed is flush, so that cows may fill themselves quickly and have time to chew the cud thoroughly, when shade is abundant so that they may lie at rest in the heat of the day while the secretions are going on; when water is plenty, that they may not become fevered with thirst; when salt is given at due intervals that the soda of the bones and the saline matter of the milk may be supplied, and when they are taught to come of their own accord to the milking place instead of being stoned from a back lot by boys or chased by a cur, the process of transforming the food into milk will go on with speed and regularity as does all of Nature's operations when her laws are respected. But neglect of these and similar essentials will make the dairyman's profits small. Scant pastures will cause shrunken udders, while continual exposure to the hot sun, or insufficiency of water, or non-supply of salt, or fright and exertion as from being dogged or clubbed, will each and all tend to fever and an impaired condition of the health of the animal, and react at once upon the quality of the milk. The same results occur from the browsing of tansy and other weeds which, when pastures are short, are sometimes eaten by cows, although at other times they will not touch them; from the drinking of stagnant water, which in the autumn has been known to produce the still more serious evil of abortion, and also from the injudicious use of certain kinds of food, as for instance, turnips. The bad taste of these last, it is said, may be avoided by liberal salting, but it is doubtful if it has ever been wholly overcome by this means. The better way is to cook vegetables, which, when fed raw, communicate a bad

taste to the milk. During those months when the pastures are more or less scorched by the sun, and their grass loses its succulent qualities, unless other fields covered with thrifty clover have been provided for grazing, it is of course necessary to resort to feeding with green corn fodder and the like; this from its nature most closely resembling grass. Later, when vegetation of this kind is nipped with frost, sweet roots like the sugar beet or mangel wurtzel are the most available, always excepting that cheapest and best for autumn feeding, the pumpkin, which makes the milk rich and the butter yellow, but the seeds of which should always be removed before feeding, as their peculiar medicinal effect is not required by healthy animals. These truisms, known to every farmer, but too often disregarded in more than one respect, indicate the first principles of successful butter making.

Good milk is the essential prerequsite of good butter, and to secure this the milk machine must be kept in the best working order. There is a scriptural injunction against muzzling the mouth of the ox that treadeth out the corn. A parity of reasoning will apply the same doctrine to the female of the bovine race, and probably no one is more amply rewarded for being "merciful to his beast" than the dairyman whose pastures are tenanted by well-fed, well-watered, well-tended and contented cows.

MILKING, AND MILKING MACHINERY.

The treatment of milk for dairy purposes may be very properly said to commence with its extraction from the udder; for this has a direct bearing only second to the causes previously specified, both upon the quantity and the quality of the milk, for if a cow be roughly handled she will withold a portion of the yield. So, too, if in the milking operation the last drops are not fully withdrawn, not only will "the strippings or" richest portion of the milk be wasted, but the quantity left in the teats will be liable to coagulate and injure the udder; and, as is well understood, shrink the product of subsequent milkings. Several milk machines have from time to time been invented, but have proved objectionable for one or the other of the causes above indicated. One of these exhibited at the fair of the American Institute two years ago was in its way a curious illustration of how not to do it. It was composed of two corrugated rollers geared together like the rolls of a wringing machine, but placed about a quarter of an inch apart. The cow's teats were to be placed between these rollers, and the

rotation of the latter was expected to compress the teats, at intervals between their radially projecting portions, and expel the milk. The apparatus of course never amounted to anything, but has a slight interest as one of the vagaries of invention. A more practical, and for that reason, a more mischievous milking device is a little tube to be thrust up the teat to allow the milk to run out by its own weight. This is simply an imitation of the goose quill which lazy milkers are sometimes accused of inserting in the teats for the same purpose. The practice cannot fail to distend the orifices from which the milk is drawn, thus leading to an involutary loss or, if long continued, to local inflammation or induration of the immediate surface of the parts. The famous cow milkers, about which so much has been said during the past ten years, are made with four conical India-rubber cups, or teat-holders, which are placed upon the teats; the cups are connected with a pump, which may be operated either by power or by a lever worked by hand. This pump draws the milk from all four teats at once, the milk flowing through a spout to the pail. The writer having witnessed the practical use of the machine feels compelled to say that as far as its mechanical operation is concerned it is a success. It cannot injure the teats; the milk is drawn in a smooth current and much quicker than on the average it can be done by hand. As drawbacks to these advantages the machine is, from the very nature of the case, somewhat expensive; just a little likely to be deranged by use; requires some skill in its manipulation, and does not milk as clean as is done by the ordinary means, so that it is necessary to "strip" by hand. For these reasons, while it deserves a trial in large dairies it is not likely to come into extended use where only a few cows are kept. Milking machines must, therefore, upon the whole be classed with the self-binder for harvesters, and the self-loaders for hay-riggings, as things not yet fully wrought out to meet the rigid requirements of ordinary farm experience. In falling back from the contemplation of ingenious milking machinery to that of the good old way, it may be well for the milker to reprobate one or two hobbies semi-occasionally put in practice, as, for instance, the wetting of the teats with milk, which forms a greasy varnish upon them, that, to say the least, does no good whatever, and the practice of keeping the "strippings" back to mingle with the cream, under the mistaken notion that the increase in the quantity of butter will pay for the trouble of doing it.

COMPOSITION OF MILK.

Fresh milk has been frequently analyized by chemists. with somewhat varying results, due, it may be presumed, to differences in the feeding and general thrift of the animals. Thus, the proportion of casein or cheesy matter, is from three and one-fifth to four and one-half per cent; of butter, from three and one-eighth to four and one-tenth per cent; of milk sugar, or lactine, four and three-fourth to five and one-tenth per cent; of saline matter, from one-fifth to three-fifths of one per cent, and of water about eighty-seven per cent. Each one of these constituents plays an important part in the chemical changes that take place in the milk preliminary to and during the formation of the butter. The analysis of milk to determine the relative proportions of its constituent parts is a comparatively simple matter to the chemist, and, being capable of more lucid explanation than many other processes of a similar nature, a brief sketch of a good method may not be without interest to those who like to understand something of the means by which the facts of practical science are ascertained. The portion of milk to be analyzed is carefully weighed, after which a few drops of acetic acid, the same as the acid of vinegar is added to it. This will cause coagulation, and the vessel containing the milk should then be set in an other vessel filled with boiling water, and kept hot until all the liquid in the inner or milk-holding vessel is evaporated. If we now weigh the dry residuum of the milk, and subtract the weight from that of the original quantity, we obtain the weight of water contained therein. The solid mass, or residuum is then taken and digested for a length of time in ether which dissolves out the butter. The ethereal solution is heated to its boiling point, is filtered through porous paper, and evaporated to dryness, thus leaving the butter as a residue, which may then be weighed. The butter will of course have its peculiar color, which will be found sometimes darker, sometimes lighter, according to the food on which the animal has fed.

Having thus ascertained the proportions of water and of the butter, it is next in order to determine those of the casein, the milk-sugar, and the saline matter. To do this, the surplus left on the filter after filtering the ethereal solution above mentioned, is washed with hot water. This dissolves the sugar and a part of the salts. The aqueous solution thus obtained is separated by filtration, evaporated to dryness, and the product is weighed. The latter is then burned, and the weight of the ash, composed of mineral salts, is subtracted

from the weight of the product just named ; the difference indicates the weight of the milk-sugar, which was consumed in the burning. What remains is casein mingled with a portion of the salts ; in order to separate the casein the material is burned. By taking the weight of the ash from that of the material we have the weight of the casein, and by adding together the weight of the two portions of ashes we have the total of the inorganic salts or saline matter.

Butter, which is a fatty substance, containing no nitrogen, exists in milk in the form of minute globules, which are not opaque, as might be supposed, but transparent. Each globule is surrounded by a thin covering or skin believed to consist of casein, and, instead of being of spherical form, the globules are lens-shaped. This gives them the property of dispersing light in all directions, and, as they exist in immense numbers this dispersion of rays communicates a white color to the milk. Some cows give blue and others an unusually yellow milk. This arises in each case from an unnatural cause. According to some investigators, from the presence of microscopic vegetation that draws its sustenance from the milk as ordinary plants do theirs from the soil. Others assert that the abnormal tints are due to animalcules, and have given them hard latin names, that found in the blue milk being termed *vibrio cyanogenus*, and that in the yellow *vibrio xanthogenus.* As to the casein we have seen that a portion of it is probably comprised in the coverings of the butter globules, the greater part of it, however, exists in solution in combination with the soda, the province of this alkaline salt being to thus hold the casein in the proper condition. The milk-sugar is simply dissolved in the liquid, it is not very sweet compared with ordinary sugar, although it gives the sweetness peculiar to fresh milk. Its great characteristic is the facility with which it is converted into lactic acid, which serves a most important part in the production of the butter, as will presently be seen. This transformation of the milk-sugar is excited by the incipient decomposition of the casein.

When milk is set away at ordinary temperatures the butter globules, being the lightest rise to the top, and thus aggregated constitute the cream. At from fifty-five degrees to fifty-nine degrees the milk is more limpid than when of a lower temperature, and the cream rises more readily. If made warmer than fifty-nine degrees the incipient decomposition of the free casein is unduly hastened ; this causes the premature conversion of the sugar into lactic acid. The acid

neutralizes the soda that holds in combination the bulk of the casein and causes the latter to coagulate, as is seen in sour or lobbered milk, and this thickening of the milk prevents the further rising of the cream. The best results are said to be attained when the milk has a depth of from one and a half or two inches in the pans. Zinc pans possess the curious property of retarding the souring of milk from four to five hours as compared with that kept in tin or wooden vessels. In the absence of definite knowledge upon the matter the reason of this may be inferred to be that the lactic acid first formed is neutralized by combination with the basic oxyd on the surface of the metal. The use of zinc for this purpose is, however, highly reprehensible because the salts of zinc are poisonous in a high degree, and cases have been known where persons who have used butter made from milk and kept in zinc vessels have suffered severe and nauseating attacks from this cause. Glass and tin, which are practically incorrosive, and wood, when kept perfectly clean, are the best materials for vessels in which milk or cream is to be held. The cream being skimmed and collected in sufficient quantity is ready for conversion into butter, pending the full consideration of which a few paragraphs may be devoted to

THE THEORY OF CHURNING.

We have seen that butter exists in milk in the form of minute globules, each enveloped in a minute cyst or sac. The operation of churning consists, first, in breaking these sacks to liberate the butter; and, second, in causing the butter particles to adhere together, that the product may assume consistency and solidity. The rupture of the globules is secured by friction, partially by their rubbing against each other, and partially by the rubbing upon them of the surface of the churning mechanism. The kneading together of the liberated butter is done by bringing them forcibly in contact, and for this purpose the means employed to bring about the first stage of the churning process is commonly sufficient. When we speak, however, of the liberation of the butter by friction, it must not be supposed that ordinary churning depends wholly on mechanical agencies. Air admitted to the milk or cream while being agitated, the oxygen acts upon the milk-sugar, and changes it into lactic acid, which, as previously explained, coagulates the casein in clots, such as are seen in the buttermilk and acts indirectly to facilitate the rupture of the globules. As a matter of curiosity, it may be mentioned

that butter may be churned from milk in the entire absence of air, but the process is more tedious. Some years ago somebody invented a method of churning in which he proposed to pump the air all out of the milk, under the belief that the globules would swell up and burst of themselves. But it needless to say it failed to meet his expectations. The warmer the milk or cream the more readily will the sacs or coverings of the butter globules break; but, on the other hand, the higher the temperature the softer the product, and the more difficult to make it hard and firm by working. When the cream is too cold the churning process is interminable, and there is some reason to suppose that the butter will not "come" until the whole has been brought to the requisite degree of warmth, in the absence of other means, by the heat generated in the churning operation, it being a well-known fact that in the process ordinarily carried on, cream rises in temperature about ten degrees from the commencement to the end of the churning. Fifty-eight degrees has been settled upon as the proper temperature at which to commence churning, but it may be somewhat lower in summer, and two or three degrees higher in the cooler autumn months. It may be that the relative fluidity of the liquid has something to do with the evolution of the butter, for it has been shown by carefully conducted experiments in England that when the whole quantity of milk is churned the yield of butter is five per cent greater than when from the same measure of milk the cream only is employed. The reason may, however, and probably does, exists in this, that while yet in the pans the souring and coagulation of the milk takes place before the whole of the cream has risen to the surface, the thickening of the milk preventing a rising of a small proportion of the cream. As addendum to this it may be noted that the per centage of cream from milk is in a degree dependent upon its relative fluidity, inasmuch as the quantity of cream is perceptibly increased by the addition of water. In this connection it may not be without interest to briefly mention a couple of experiments related in an old English work, and made for the purpose of determining the results of churning at different temperatures. In one of these the cream at the start was at fifty degrees, at the close sixty, the time of churning four hours. The butter was of the very best, firm and well-tasted. In the other experiment the temperature ranged from sixty-six to seventy-five degrees, and the churning continued for two hours and a half. The product was inferior in every respect, and less quantity than in the former, in the proportion of

ten and three-fourths to fifteen and one-third, deficient portions being dispersed as a greasy constituent of the buttermilk. The time occupied in churning was unconscionably long in both cases. The apparatus employed may have been imperfect, but the process was undoubtedly hindered in the one case by the low temperature, and in the other by the ununiform rupture and agglomeration of the unduly heated butter molecules. Let us now turn to the mechanical aspect of the butter question, and consider the history, varieties and desirable characteristics of

Churning Apparatus.

In the veracious narrative of Capt. James Riley, whose vessel, the brig Commerce, was wrecked on the coast of Africa, and who, in consequence, was taken prisoner by the Arabs, more than half a century ago, is an account of the manner in which those people made butter from camel's milk. This was probably the old original method by which the article was produced in primitive ages, and consisted simply in putting the milk in a skin, and lashing the latter fast on the back of a camel at the commencement of a day's journey. When the tents were pitched at night the skin was opened, and a pat of fresh butter the size of a man's clenched hand taken out; the agitation of the milk by the rolling gait of the camel having sufficed to churn it. The writer has somewhere seen a statement that among some of the Indian tribes in the southern part of our own country, it was customary to fill a skin with milk, hang it up by a string, and subject it to a motion from two persons who pushed it alternately from one to the other. These rude methods, by providing for the agitation of the milk, would of course prove sufficient to bring the butter, but it is hardly to be supposed that the product would be very firm in texture, or very finely flavored. Even the crude ingenuity of ancient times must have early found a substitute for such imperfect means, but of their nature we have no certain knowledge. It is very likely, however, that some of the essential principles of construction found in our modern apparatus may have been used many ages since. It is commonly supposed that rotary churns are a recent invention, but in Tasso's Jerusalem Delivered, written more than 800 years, is mentioned a wandering princess, who took upon herself the office of a cheerful dairymaid, and who, the poet says was accustomed to sing the while—

> "The dulcet cream in *churns revolving* rolled
> Till firm the fluid fixed and took the tinge of gold."

This shows that the Yankees cannot claim the credit of originating this class of dairy appliances, but *per contra.*, if we may paraphrase Bulwer's line, "Who that hath lived knows not the tender truth" that the bonny milkmaids of our northern land may vie in charms with the royal beauty who, by the streams of sunny Italy, sighed for the absent Tancred.

The first patent granted on an American churn was granted to one Isaac Baker, doubtless long since laid to rest under the turf of his native Massachusetts, for his letters were dated February 20, 1802. Of the peculiarities of the invention we know nothing, and probably can learn nothing, the burning of the patent office in 1836 having destroyed most of the earlier records. We do know, however, that from the date of Baker's apparatus down to the 25th day of May, inclusive, not less than 1,047 patents have been granted in this country on churns alone. Probably in no other department of invention has so much ingenuity been expended to so little purpose. Any dairyman will bear witness that, notwithstanding all the multitudinous modifications and attempted improvements, there is no churn so good in practice as the old-fashioned dasher; and with one qualification, which we will presently point out, this opinion is undoubtedly correct. Still the study of these inventions is well worth while as showing the manifold mechanical devices that may be applied to secure a given result, and as illustrating how futile a thing mere genius is when kept apart from practical knowledge and a common sense way of using it. In April of 1803 two Connecticut inventors patented a churn that was rocked liked a child's cradle. Five years latter John Devotie of Vernon, N. Y., took a step forward in doing the same thing with a combined churn and washing machine, but whether the purpose to do the washing before the churning, or vice versa, does not appear. In August, 1813, Cyrus Hitchcock, also of Vernon, brought out a pendulum churn, evidently modeled to work after the Indian method to which allusion has been made. In April, 1818, one Anthony Ziernan of New York brought the promise of labor, misery and stripes to the canine race, by taking out a patent on the first American dog power for driving churns; and three years afterward two other inventors of the same State made an additional onslaught on the idle habits of poor Towser by devising another churn, operating apparatus which belonged to the tread-wheel variety. In 1831, protection on a "Method of Churning Cream by Atmospheric Air," was granted to Elias V. Coe, of Warwick, N. Y., and

in 1835 Asahel Baker of Windsor, in the same State patented a plan of propelling churns by weights; a principle that has since been embodied in quite a number of churning machines, but which, no matter how ingeniously applied, is, in practice, not worth a cent. The destruction of the patent office, as above alluded to, has left us in the dark as to the precise nature of most or all of these apparatus. It is likely, however, that their most important features have since been re-invented and applied in many different ways. This is especially true with regard to the atmospheric process, the most important of all modern improvements in the churn, as will naturally be inferred from what has already been said concerning the admission of air to the cream while being churned. All efficient forms of atmospheric churns have combined some device for forcing the air into the cream, with some variety of dasher, either rotary or otherwise. Some six years ago a claim was allowed on certain devices for churning by the use of air alone, which it was proposed to carry into practice as follows: A stationary bellows forced a current of air through a flexible tube furnished with a nozzle at the end. This nozzle was inserted below the surface of the milk, contained in a suitable vessel, and the agitation caused by the air-blast was presumed to be capable to bring the butter. About the same time or a little latter, another churning apparatus with a forcible air-blast was brought out, but this was used in connection with beating mechanism. A double acting bellows, driven by a crank and pitman, was employed to force the air into a hollow shaft arranged centrally within the churn. This shaft carries the beaters, which were formed with numerous small holes, through which the air passed from the shaft into the cream. We do not consider either of these plans of much consequence. An atmospheric churn without beaters or dasher will churn very slowly, and will not be able to gather the butter, while one that has beaters and is properly constructed will force air enough into the cream without bellows or blowing machinery.

The essential feature in a good churn is capacity for giving a steady and uniform agitation to its contents, and for doing this at the most rapid rate possible without raising the temperature of the cream more than ten degrees in the process. Uniformity in the agitation causes the butter globules to burst nearly all at the same time, while the avoidance of undue heat insures a firm, hard texture to the butter. These requisites are very well secured in several very different kinds of churns; for instance, in the barrel churn in com-

mon use in the English dairy districts for many years, and formed of a barrel made to rotate on a shaft passed obliquely through it. Also, in the old Kendal churn, in which internal rotary beaters, working on a horizontal axis, are used. The motion of a crank turned by hand is not, however, as steady as the regular up and down movement of the ordinary dash churn, which has the further advantage of being more easily worked by ordinary churn powers than any form of rotary churn. Indeed the common dash churn only requires to be provided with some common sense and efficient means of applying the atmospheric principle to be as near perfection as we are likely to attain with this class of apparatus.

Working and Curing Butter.

Butter undoubtedly contains a small proportion of casein or cheesy matter, of which nitrogen is a constituent, and the presence of this nitrogenized matter is one of the great causes of the tendency to rancidity. To obviate this tendency, recourse must be had to a curing process, which forms the second step in the preparation of the article for market, the first being the expulsion of the buttermilk which, when the butter is taken from the churn, amounts to about twenty per cent of its weight. Butter, in a pure condition, is composed of two fatty substances known as margarine and oleine, and these in their turn are made up of two acids, known respectively as margaric acid and oleic acid, which are united with an organic base, the complex scientific name of which it is not necessary to mention here. Now the oleic acid is capable of absorbing oxygen from the air, and by this means forms very strong smelling compounds, another cause of the rank smell in butter. The main cause, however, lies in the formation of butyric acid by the decomposition of the casein embraced in the article as above mentioned.

To speak to farmers of the necessity of cleanly washed apparatus, and of a low temperature in working butter, is evidently superfluous, for those who have neglected these prerequisites have been taught by the penalty of soft and rancid butter that there is a screw loose somewhere. Much more care than is ordinarily practiced, however, should be given to the *manner* of working butter. It should be sliced and chopped as little as possible, for the friction of the ladle in cutting tends to destroy the grain, the butter being converted from an aggregation of firm globules, simply adhering together, into a mass of those crushed and merged into each other,

and thus bringing the whole to a greasy consistency, which no subsequent treatment can remove. This has undoubtedly been the reason why the numerous butter working machines brought out from time to time have failed.

Up to the present date no less than fifty-three of these devices have been invented and patented in this country. Some of them have been designed to act upon the butter with working blades imitating, though only in a slight degree, the action of the common ladle. Others have been made with rollers so operated as to be rolled over the butter, or to pass it between them. One, an English invention, forced the butter through holes in the bottom of a vessel like a colander, the water dropping out of the substance as it passed through. None of them have been able to do the work as well as a hand ladle operated to expel the liquids by pressure skillfully applied to the mass. Butter properly worked should not contain more than five per cent of water, but it often contains much more, as very frequently it does of salt. Cases have been known in which these, the water and salt, have constituted one-third of the weight of the whole. Such undue proportions may be readily detected by melting a sample in a glass vial, when the constituents will separate, the salt at the bottom, above this the water, and at the top the butter. The yellow color of butter is dependent upon the nature of the food of the animal, and is deeper in proportion to the richness of the pasture. Sometimes artificial coloring is resorted to, annatto being the material commonly used, although in rare instances the juice of carrots is used as an inferior substitute.

The butter having been properly worked and salted in the usual manner, needs only to be placed in good oak receptacles, and kept covered with clear brine, in order to remain good for an indefinite period. With regard to the packing, several forms of tubs have been patented from time to time, but whether they possess any advantages over the ordinary firkin is doubtful. One of those patented a few years since had a central orifice formed in the bottom, and upon the latter a false bottom was placed, the orifice being stopped with a plug. When it was desired to remove the butter from the tub the plug was removed, the tub inverted, and the whole forced out by a stick inserted through the orifice, and pressing against the false bottom. In another the alleged improvement consisted simply in coating the inside of the tub with paraffine, which is impervious to brine and water.

Unusual Sorts of Butter.

As products somewhat different from ordinary butter, also differing from each other, may be mentioned the Devonshire clouted cream so called, and the whey butter made from the residual whey of cheese making. The former is made in this manner: Milk is strained into pans, preferably of earthenware, into each of which a little water has previously been placed, the object of this being to prevent the adhering of the milk to the pans during the subsequent process of scalding. The milk after standing about twelve hours is heated to about 180°, and then allowed to stand for the cream to rise. The heating facilitates the rising of the cream, and also assists its conversion into butter. The cream is then worked by the hand or with a ladle or flat piece of wood, forming a thickened or clouted mass of half made butter which has a rich color and toothsome flavor. It contains a much larger per centage of casein than ordinary butter, and is consequently much more liable to turn rancid.

Even when the process of cheese-making is conducted in the most skillful manner, there is always a proportion of butter remaining in the whey, which it is the practice, both in this and other countries, to recover by a very simple process. The method pursued in English cheese dairies is to heat the whey to 180°, then stir into it a moderate proportion of sour buttermilk, which causes the buttery particles to rise and aggregate at the surface. This is skimmed off, kept for three or four days, until it thickens, and then churned like ordinary cream. The quantity of butter obtained by this means is not great, the general average being about half a pound per cow per week. Its value is stated at only about seventy-five per cent of that of ordinary butter. So far as the writer is aware, only two patents on the making of butter from whey have been granted in this country. Both of these are recent, and, judging from the information at hand, do not appear superior, either in efficiency or cheapness, to the old method just described.

The liability of butter to turn rancid, and the objection in some regions to the use of salt as a preservative agent, has led to the use of other means of preparation which change somewhat the character of the article, and thus produce what may also be properly termed distinct kinds of butter. Of these is the butter brought to Constantinople from the Crimea and the Kirban on the shores of the Black sea. This is kept sweet by the following treatment: It is melted over a slow fire, the scum is skimmed off and a little salt is

mixed with it. Butter thus prepared, it is said, may be kept for two years without the slightest change. The chemist Thenard recommends a similar plan with the entire omission of the salt. His directions are, to melt the butter at a heat not exceeding 140°. This should be kept up until the cheesy matter has settled to the bottom. The butter will then be perfectly transparent, and after being strained through a cloth must be cooled with ice or cold spring water; in this condition it may be kept sweet for six months or more, but in order to restore to it the taste of fresh butter it must be carefully worked with one-sixth its weight of cheesy matter previous to use. The same author asserts that the bad taste and odor of rancid butter may be in a great measure removed by melting and cooling it in this manner.

Another, but very different mode of curing butter, is to make a mixture of one part sugar, one of nitre, and two of the best rock salt, rolled together to a fine powder, and incorporated in the fresh butter, in the proportion of one ounce to sixteen. This butter does not taste well until it has stood for three or four weeks, after which it acquires a rich marrowy flavor.

In closing these remarks on the preparation of butter, the necessity may be noted of keeping it away from all bad smells or foul gases, which it is very liable to absorb. Care should therefore be taken that no tainted meat, decaying vegetables, stagnant water, or other scource of effluvia, be tolerated where the golden colored is stored awaiting market day.

Dr. J. V. C. Smith moved a vote of thanks to Prof. Whitney for his valuable paper, which was adopted.

Adjourned.

July 27, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

The first business in order was the reading of a letter from Mr. J. G. Gebhard, of Schoharie Court House, N. Y., which had reference to

Pulverized Shale as a Pest Destroyer.

Our readers may remember that the subject was considered at a previous meeting, and it was suggested that the gentleman who claimed to have made the discovery be invited to send some of the article for trial by members. On this hint he acted, and a score or

more of large packages were forwarded and distributed. In his note he said: "After actual experiment, I have found it to be a specific against the operations of all species of worms and bugs which infest the garden; and, notwithstanding the fact that Dr. Trimble declares it to be against the teachings of science, I can assure you that it still continues to make the currant-worms and squash-bugs 'move.' My neighbors have all used it, and in many instances have arrested the ravages of worms after half of the bush had been destroyed. I have found it equally effective against all varieties of worms destructive of fruit trees, rose bushes, &c. The better time for applying it is while the dew is on or after a rain. The principal constituents you will find to be carbonate of lime, sulphate of lime, sulphate of alminum, phosphate of lime, magnesia, sulphur and silex. We have used it as a fertilizer with better results than Nova Scotia plaster, particularly upon leguminous plants."

Dr. Isaac P. Trimble.—It may be well at the outset to consider what shale is. Many might suppose from this communication, and the specimens sent, that it is something new as well as important. In the Piedmont region, on the sunny-side slope of the Blue Ridge, shale is one of the chief constituents of the soil. Eastern New Jersey has a red shale, and you can generally see some of it on the boots of gentlemen who come in from that locality. The Germans there spread it on their gardens and vineyards, and they think it may be of some value as a fertilizer; nevertheless it is merely earth, and the commonest kind of earth. If it will kill insects, and I have yet to be convinced that it will, it must be on the principle of killing by dusting, and any other dust would answer as well. Still, as it is not best to examine the dental endowments of an equine gift, so, on the same principle, perhaps it would be better for us to make some trial of this thing before sweeping it aside with a flourish.

Mr. Wm. Lawton.—I quite agree with the learned gentleman who has just addressed us. So long as the inevitable conditions of existence continue to have influence, the principles hinted at must hold sway.

How to make Concrete for Buildings.

Mr. J. B. Tattershall, Hamilton, Mo., inquired by letter for suitable instruction in regard to the building of concrete walls of water-lime, how to mix the mortar, &c. In his section there is neither brick nor stone; consequently, the question asked becomes an important one to himself and his neighbors.

The Chairman.—If there is no one to respond to this important inquiry, I will venture to reply to him, by advising him to get Todd's Country Homes, a book of over 400 pages, which contains 40,000 things, more or less, and among them, as I remember well, a chapter devoted especially to making concrete houses. He will get all the details requisite in that treatise.

PLUMS.

Mr. C. K. Landis, of Vineland, N. J., sent a box of plums entirely free from curculio stings, as the Vinelanders have bound themselves with an oath of determination to rid their town of the ravages of this little "Turk." Dr. Trimble said the battle was fought by all the people acting simultaneously all over the town.

HINKLEY KNITTING MACHINE.

Mr. H. E. Towle, of No. 176 Broadway, presented a knitting machine to the Club, and appeared on the stand to show its operation while knitting any style of garment, from undershirts to stockings. The machine is operated by turning a crank or with the foot, and its operations were highly approbated as a valuable labor-saving household device.

EARLY QUEEN POTATO.

Mr. T. E. Burtis, of Queens, Long Island, sent a package of a new seedling potato, which he calls the "Early Queen," which were distributed and received as a superior variety.

CROSSING GALLINACIOUS FOWLS.

A letter was received from a southerner asking for some eggs similar to that one exhibited a few weeks since by John Sarell, of Brooklyn, to which he replied: "I have no eggs to sell. If those persons desire to improve the breed of poultry, the same law regulating the breed of sheep is also applicable to these birds. In order to get first-class layers and first-class chickens for the table, you must breed from pure breeds. The Indian fowl is best (the game fowl will answer), crossed with the Dorking; will produce stock unequaled. They are strong and vigorous as chickens; their flesh is white, firm, and of a fine flavor. The flabbiness of the Dorking is counteracted by the hard, grizzled flesh of the Indian fowl. I should feel a pleasure in forwarding stock to any one, if I had it to spare, but having only a city lot twenty-five by one hundred feet, there is no room to raise many."

Saving Good Seed.

The regular paper of the day was read by Mr. S. E. Todd, as follows: "In an old book, which has survived the downfall of kingdoms, the wreck of nations, and the crash of worlds, many of whose precepts were penned by hands calloused with the industry of virtuous life, we find allusion to sowing good seed, from which it seems to be safe to assume that ages ago tillers of the soil cherished some correct notions with regard to good seed, in order to be able to produce a satisfactory crop. In still another book of ancient origin, which contains an interesting chapter on various agricultural topics, we find the following suggestions:

> "Some steep their seed, and some in cauldrons boil;
> With vig'rous nitre, and with lees of oil,
> O'er gentle fires, the exub'rant juice do drain,
> And swell the flatt'ring husks with fruitful grain,
> Yet, the success is not for years assured,
> Though chosen is the seed, and fully cured,
> Unless the peasant, with his annual pain,
> Renews his choice, and culls the largest grain."

Everything in the vegetable kingdom, as well as in the animal, from the most delicate flowers to the stately monarchs of the forest, is controlled and regulated by laws that are as unalterable as the grand laws which control the rolling spheres. Seeds germinate, plants spring into life, trees and vines bend beneath an abundance of luscious fruit, and the broad fields are crowned with a golden harvest, all in conformity to established laws that are as reliable as the vicissitudes of the seasons and the changes of the year. One must be forever annihilated and go out of the Creator's universe, if he would dwell where everything around him is not controlled by a wise and good law. And it is the business of the tiller of the soil to investigate the phenomena round about him, and to make himself familiar with the intricate operations of the numerous laws by which sustenance is provided for the human family, for the beasts of the field, and the fowls of the air. As the husbandman becomes more and more familiar with the operations of the laws that affect the growth and perfect development of the products of the field, and as he learns to conduct his labors in accordance with those laws, he finds the labor of his hands more bountifully rewarded. On the contrary, as he blunders along through life without knowing whether his efforts harmonize with the grand laws with which he has to do, he meets with irreparable losses and sore disappointments. And all these discouragements

arise from this one fact—a want of correct understanding of the laws of the vegetable kingdom.

On many of the best wheat-producing farms of our country, the soil yields only a light crop of grain, where the product might be fifty bushels of fine wheat per acre, with the same expense of cultivation and harvesting were the operations of the tiller of the soil all conducted in accordance with the laws of the vegetable kingdom. Let us dwell on a single thought touching the seed. It is utterly impossible to reap a full crop, even when the soil is all right, if the seed is not perfect or thoroughbred. It is quite as proper to speak of thoroughbred seed of any kind as to allude to thoroughbred animals, as the highest degree of perfectibility is attained, in either case, by conducting the operations incident to propagation in strict conformity to established laws. We have what are termed thoroughbred horses, neat cattle, sheep, and swine, whose ancestry can be traced back from dam to sire, or from sire to sire, for a long term of years; and every individual in the long lineage will be characterized for that peculiar quality of transmitting to his offspring, with satisfactory certainty, those points of excellence which represent that peculiar breed. So, for example, when a farmer has a variety of Indian corn which produces, from year to year, ears and kernels of uniform size and color, and among which not a single red ear, blue ear, or an ear bearing mixed grain can be found for many successive seasons, he has a variety of thoroughbred corn, the seed of which will yield a crop in abundance, just in proportion to the condition of the soil, making due allowance for a yield within the prescribed laws of limitation. And the same is true of wheat, oats, rye, and barley. If a farmer would raise forty or fifty bushels of fine wheat per acre, 100 of oats, eighty of barley, and sixty of rye, where now the yield is by no means satisfactory, the important step will be to secure thoroughbred seed. But a supply of such seed cannot be obtained in a single season. The labor and careful cultivation requisite to the production of a variety of wheat that will yield a bountiful crop of plump grain, all true to its kind, will be found nearly equal to the production of a new and valuable breed of domestic animals. But improvement in seed grain of all kinds is a subject of transcendent importance to every tiller of the soil. And there will be no more favorable opportunity to commence the improvement of seed during all the year, in this latitude, than the present harvest. When we go into a field of golden grain, nearly ready for the harvesters, we can usually see that Dame Nature has already

commenced improvements in the seed for the future crop. There seems to be a concentration of the energies of certain plants to develop a more perfect variety. Instead of deterioration, nature's efforts always tend to more complete development. There is an ear of wheat, for example, or of barley, or rye, or a pinicle of oats, each of which is earlier, larger, plumper, and fairer than the ears all around it. If allowed to grow until the crop is fully ripe, these seed heads will be dead ripe, and in some instances will have fallen to the ground. The largest and best kernels of those heads have been developed by an effort of nature with direct reference to the production of a thoroughbred variety of grain; and if those ears be gathered with care, and the seed planted in a congenial soil, and all bastard heads be culled out for a few seasons, and an effort be made to establish a variety of grain with unusually large heads and plump kernels, possessing the important characteristic of great prolificacy, the efforts of the tiller of the soil will be so consonant with the laws of the vegetable kingdom that he will have the satisfaction of seeing not only two ears of fine grain appearing, where now only one is produced, but they will be much larger, heavier, and far better in every respect than the miserably inferior seed that is relied upon for the crops of our country. American farmers lack faith in the production of thoroughbred seed of any kind. They continue to plow and sow, reap and mow, in that same old channel where their fathers trod, when, with a little care in raising better seed, their crops of all kinds might be doubled. A few thoroughbred varieties of wheat might be made to work as great changes in the production of cereal grain throughout the grain producing districts as have been wrought by the introduction of thoroughbred Durham stock. But our farmers have not availed themselves of one-half the advantages which might have been derived from the introduction of such thoroughbred stock among our herds. And the same is true of all kinds of grain. If a choice variety of wheat or oats be introduced, the system of management is so imperfect that in less than four years the variety will have lost its identity, simply because proper efforts were not made every season to maintain the purity of the thoroughbred variety. Where is the prolific variety of the pedigree wheat, the ears of which were uniformly six inches in length, and all of a proportionate size, which would yield forty or fifty bushels of beautiful grain per acre? What has become of the excellent Treadwell wheat, a thoroughbred variety? Where are a long

list of other thoroughbred varieties of golden grain, that used to roll out forty or fifty bushels per acre? Why, by slip-shod management the seed—by not putting forth proper efforts every season to maintain the original purity of the thoroughbred variety—has run out. Now, then, in order to get back to the same standpoint in the improvement of grain that was once occupied, farmers must make themselves familiar with the laws of the vegetable kingdom, and produce new and thoroughbred varieties of such grain and other seed as they desire to cultivate, and then study the requirements of the growing plant as to the conditions of soil. And when the efforts of the intelligent husbandman are brought to harmonize in every particular with those laws that control the development of the products of the field, he may rely on the production of a beautiful crop with the same assurance that he now waits for the opening of the growing season.

Dr. J. V. C. Smith.—I rise, Mr. Chairman, to request the reporters to give Mr. Todd's remarks to the people. I must express my unqualified approbation to what he has said. He always talks sound sense, and I have always admired the very modest and unassuming manner in which he communicates whatever he has to say before this Club. His thoughts are always so well expressed and so instructive and practical, that I sometimes apprehend we do not appreciate what he says; and what gives a greater value to what he says is, it comes from a source that inspires us with confidence. And there is another gentleman bearing the same name, who possesses a remarkable faculty of making himself useful, and what he has to say very instructive. I allude to Rev. John Todd, of Pittsfield, Mass. I had the great pleasure, a few days ago, of listening to a lecture of that distinguished speaker, on the immense agricultural resources of California, from whence he had just returned. It was truly wonderful to hear him tell of the immense crops that the tillers of the soil gather in that golden region, from the slighest solicitation. He drew the most charming and bewitching pictures of the overflowing abundance of that delightful country. Why, if I were a young man, I could not be induced, by any ordinary consideration, to stay away from that delightful country. We have no correct conceptions of the wonderful fertility and the great breadth of country that is spread out west of us. If our surplus population could be persuaded to abandon their dismal abodes in our overflowing cities, and go away into that beautiful country where the climate is so salubrious, and the

products of the field spring up almost spontaneously, how infinitely better it would be for them and for others around them. If they would go there and establish beautiful homes, they would enjoy the blessings of abundant harvests, and we have the luxury of cheap and luscious fruits.

Now then, during our brief vacation, if any of you go in the vicinity of Dr. Todd, of Pittsfield, do not fail to go and see him, and hear him talk about the wonders of California. I sincerely wish we could make arrangements here to have him lay before the people of the country the thrilling intelligence which he has the happy faculty of communicating in such an instructive manner. In conclusion, Mr. Chairman, permit me to express my implicit confidence in the Todds.

A motion was then made that at the close of the session the Club adjourn to meet again on the last Tuesday of August, which was carried.

Adjourned.

August 31, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

ANGLE-WORMS.

Mr. J. V. Langworth, of Alfred, N. Y., says he tried twenty bushels of salt to the acre to kill angle-worms, on the recommendation of the Club, some two years ago. The worms seemed, like other cattle, to like the salt.

Dr. Isaac P. Trimble.—In the first place, I would like to know whether any farmer needs to kill the angle-worms in his soil. My idea is that they benefit the earth and fit the substances they eat for plant-food. If he wants to get rid of them let him turn them up and give the poultry a chance at them.

Mr. Wm. Lawton.—That is my idea. I never drive hens out of the garden. Where they eat one seed or peck one tomato, they devour three worms or bugs.

Mr. A. S. Fuller.—What breed of hens do you keep, Mr. Lawton?

Mr. J. B. Lyman.—Three or four different kinds; Brahmas as big as a turkey, game, dorkings, &c.

Mr. D. B. Bruen.—My Brahmas will eat a cabbage just as quick as a cow, and nearly as fast.

Mr. Wm. Lawton.—I allow for the appetites of my fowls. If they bite the outside leaves of a cabbage, they are welcome to. So of

tomatoes. They are welcome to all the tomatoes they want, for it makes them healthy to eat good, ripe tomatoes.

Mr. A. S. Fuller.—I consider that a big gang of fowls in my garden and orchard, will do fifty dollars worth of mischief.

Mr. Wm. Lawton.—I will show gardens and grounds against any man in this club for cleanness and thrift, and my hens and chickens have as free range as my children and grand-children.

COMPOSTING OF OFFAL.

The same writer asks how he shall manage the offal of the sheep he kills.

Prof. J. A. Whitney.—All he wants is good dry muck or fine clay. The pile of muck and offal should be shoveled over several times so as to bring the animal and the vegetable refuse in close contact.

TOBACCO REFUSE

Mr. John W. Dickens, Louisville, Ky., has several tons, and asks what use can be made of it.

Mr. Horace Greeley.—I gave ten dollars a ton last spring for strips, to use as mulch on my orchard. I may have given too much, but I am sure my orchard was benefited, and I think the borer and other pests were kept away.

Mr. A. S. Fuller.—I doubt whether you did give too much. My advice to that Louisville man is to use his strips as manure on his grounds. They need them for manure in Kentucky about as much as they do here, though they may not think so.

Prof. J. A. Whitney.—By analysis the dust and strips of tobacco should be very useful as manure. They are rich in potash and other elements of plant food.

Dr. Isaac P. Trimble.—The best application I ever tried to drive away bugs and worms from plants is a very strong tobacco tea. But it must be very strong. It will disgust lice, thrips and small bugs, but not the curculio.

THE POMOLOGISTS IN SESSION.

The American Pomological Society invite the Farmers' Club to meet them by delegation on the 15th of September, in Philadelphia.

The Chair named Messrs. Trimble, Chas. Dowling, Hicks, Quinn, Hexamer, Lyman, and Todd, as delegates to Philadelphia.

PLASTER ON SWAMP LAND.

Mr. A. J. Pass, of Hinesburgh, Vt., asks if it will do good?

Mr. Horace Greeley.—Nothing will do his swamp land much good till he ditches and drains it. Then lime is a more suitable application than plaster.

THE DOTY PRUNER.

This invention was shown by the originator Mr. M. Doty, 32 Cortland street, New York. A tube seven or eight feet long, made of sheet-iron galvanized, has a hook on one end and a sharp chisel resting on a spring, pushed by a ramrod so as to pass across the face of the hook; this is laid on the limb to be cut, and the ramrod driven up by a sharp push. It works faster and with more precision than any other pruner.

PRESERVING FENCE POSTS.

Mr. T. Rogers, Port Leyden, N. Y.—I would also like to know from the Farmers' Club the cheapest and best preparation to preserve the ends of posts that are set in the ground.

Mr. J. B. Lyman.—First let them be well seasoned. Set the ground end in hot tar and let it boil fifteen minutes. When cool cover with coal tar, thickened with ground slate or ground brick. The boiling stiffens the albumen and causes the pores to absorb tar, The coating prevents the action of moisture. But this treatment of green posts would do very little good, and perhaps mischief. A boiling in lime-water is also beneficial. Timber that is first water-logged and then well dried lasts well, because the water soaks out the acid that starts the decay.

SHALLOW PLOWING IN A DRY TIME.

Mr. Chs. Hartlock, Clinton, Mo., asks about the depth to which a prairie sod should be turned.

Mr. Horace Greeley.—The depth at which a prairie sod should be cut by the plow depends on the length of the grass roots. They must be broken in such a way that both ends will die, that which is lifted and that which remains below. In many cases this depth may not be over three or four inches; but this has nothing to do with the general question of deep tillage, about which so much that is false and mischievous has been said in this room. I consider it absolutely wicked for speakers to foster the lazy and ruinous practice of planting our great crops on a surface stirred but three inches deep. I have traveled some this summer, and in Virginia I saw 10,000 acres that will not yield five bushels to the acre. I saw acres on acres that will not give one sound, big ear. On some soils where the roots get down

through alluvial deposit despite shallow plowing, the yield is good. But if the teachings of Mr. Pettit and others are to be taken as true doctrine, it will damage our farmers millions of dollars yearly. I fancy that the mischief already done is the value of many million bushels. In a dry time, and August is generally a rainless month all over this continent, corn on three-inch plowing fails at once; three or four days will destroy as many million barrels. If those Virginia fields had been stirred eight or ten inches deep, they would have made a good crop of corn.

Mr. Wm. Lawton.—I am rejoiced to listen to these remarks. We have done wrong, very wrong, to let any word go out from us that would encourage the practice which the gentleman who has just spoken so justly condemns.

Mr. A. S. Fuller.—I said last spring that David Pettit's letter, if it influenced as widely as it was read, would do more mischief than all the good this Club ever accomplished. Farmers are lazy enough anyhow; and he says three inches is deep enough. I think eighteen inches is shallow. I have flowers on a bed spaded eighteen inches, and others on a bed two and a half feet, and those on the deep bed show none of the effects of the drouth. I hope Mr. Greeley will continue to fight the shallow, mischievous doctrine that originates in a corner of the State of New Jersey, and tends to the ruin of our agriculture.

Dr. Isaac P. Trimble.—The idea of charging the failure of the corn crop solely to shallow ploughing, is entirely unfair. Much consequence as we may be disposed to attach to the influence of our proceedings, we certainly cannot be quite so vain as to believe that any recommendation of ours would have such immediate and extended effect as has been intimated. The entire agricultural world does not, I fear, read the reports, and we must not set too high a valuation upon our power. Mr. Greeley is under a great misapprehension as regards the quality of Salem county soil, and the fact remains that some fields there which were plowed six inches yielded a poorer crop than others plowed half that depth. I repeat, and I solicit proof to the contrary, that the Salem county cultivators grow, year after year, the best corn crops in this country. Mr. Greeley should see their great reaches of land devoted to this cereal. They get from sixty to eighty bushels to the acre, and they plow three inches deep. These are facts which cannot be gainsayed, and which cannot be got over or swept aside with a flourish.

Cisterns and Filters.

Mrs. A. G. Robinson, North Nassau, N. Y., asks advice in relation to cisterns and filters.

Mr. J. B. Lyman.—In Louisiana, where rain or the muddy water of the Mississippi is the universal fluid, a filter is used made of a peculiar kind of stone, a variety of sandstone. The housekeepers usually have two cisterns, one of which is filled with a winter rain, this is used for drinking and cooking; the other, filled by early summer showers is used for washing and bathing. The best way of making a cistern is to divide it with a partition, near the bottom of which is a box filled with a mixture of sand, gravel, stones and charcoal. The water is forced through this filter by the pressure. As to the best material for underground cisterns, much depends on the soil and situation. All things considered, it is doubtful whether wood is not the best material. It cuts off all communication of the water of the cistern with water in the earth. It is easily cleaned, is not costly, can easily be renewed, and made of the best timber lasts from fifteen to twenty years. But the wood should be boiled first, and if treated with a coat of copperas water moss may be prevented. No matter what material is used, a filter of successive layers of charcoal, gravel and sand cannot be dispensed with if first-class water is the object.

Mr. Ward Bullard, Weybridge, Vt.—Mr. Whitney does not, in my opinion, give the best answer to the question, "What is the cheapest and best remedy to purify cistern water, and keep it from stagnating and smelling in warm weather?" I would say, *let your spout run to the bottom of the cistern.* You will then have new water every time it rains. The old water will be buoyed or borne up and thrown off. Sometimes a single rain will throw off all the old water and give entirely new. If you have any doubt of this, fill a pail with water, run a tube to the bottom of it, and by means of a tunnel turn more water into it by way of the tube, and you will see that the water you turn into the tube will go to the bottom of the pail, and the water you put in first will be thrown off.

Draining Tiles.

A North Carolina correspondent wrote to solicit information about tiling land for farm purposes, such as size of tiles required, depth to place them, and what distance apart; also what is the best make of tile for that purpose, and any other suggestions that might be useful. The lands are, in part, heavy clay and sandy loam.

Mr. A. B. Crandell.—It is only recently I read, in fact, I frequently see in exchange papers, long pleas for drainage. Our questioner is fortunate in having passed that primary stage, but there are still multitudes of farmers all over the country, who have yet to be convinced that drainage pays even in light, sandy soils. I remember that books have been written, one by George E. Waring, Jr., devoted entirely to this matter; so our correspondent will understand how impossible it is, in the time at our service here, to discuss the subject with any satisfactory fullness. It is to be said, however, in a general way, that by far the best drains are underdrains, and that by far the best underdrains are those constructed with tiles or burnt clay pipes. The first form of those used was that called the horse-shoe tile, which has the shape of an arch, leaving the unprotected ground for the water to flow over. This was superceded by the round pipe and the sole tile. Experience in both public and private works in this country, and the cumulative testimony of English and French engineers, have demonstrated, says the authority just named, that the only tile which it is economical to use, is the best that can be found, and that the best, much the best, thus far invented, is the pipe or round tile and collar, and these are unhesitatingly recommended for use in all cases. The usual sizes are one and a quarter inches, two and a quarter inches and three and a half inches in interior diameter. In the selection one must be governed by the quantity of water to be carried away. The common mistake is too large minors and too small mains. One and a fourth inches is generally large enough for minors, unless they are of great length, in which case the latter may be two and a quarter inches. The mains should be able to carry off all the water brought by the minors. And here it is to be remembered that one three inch pipe is equal in capacity to nine one inch pipes; that is, all the water that can be brought by six half-inch pipes, will be carried off by one three inch pipe. The depth of drains should never, in the Northern States, says Mr. Charles L. Flint, Secretary Board of Agriculture of Mass., be less than three feet, and, if the soil is easily worked, four feet; while in the south where the frosts do not penetrate the ground, the depth may be lessened to two and a half or three feet. In sandy or light soils four feet is the proper depth. One of the most difficult parts of the operation, is to determine the number and position of the drains. As far as practicable they should run parallel with the inclination of the slope; when laid three feet deep, they should be forty feet apart, and if deeper, as in lighter

soils, sixty feet may answer. A fall of three inches in a 100 feet is all that is absolutely necessary, and this can be secured in almost any field, however level it may appear to the eye. Above all things don't have the outlet higher than the other part.

Marketing of Farm Produce.

Mr. T. Copeland, of West Dedham, Mass.—In the New York papers I notice an article on the low prices of farm produce received by the farmers on Long Island; the same complaint holds good in all other parts of the country. The farmer as a general thing, is the hardest worked and poorest paid of any class in the community. Why is this, and how long will it continue?

It is so because of the law of monopoly as made and kept up in all cities and large towns, and will continue until a radical change is made in regard to these laws regulating buying and selling. In Boston, and I suppose it is the same pretty much everywhere, the producer carrying his load of vegetables to the city, unless he has an interest in some stall in our markets, is compelled to take just such prices as stallmen or middlemen will pay for his produce. If he stops and tries to sell his wares outside of such monopoly, he is politely waited on by Mr. Policeman, and ordered to decamp or attend the police court; and pay a heavy fine for breaking city ordinances, and for what? Because, forsooth, he is trying to get pay enough for his goods to get back a new dollar for an old one, and give the consumer a chance to procure fresh vegetables at reasonable prices. A great sin this, surely; and this in republican America!

Why, in Quincy market, lessees of stalls pay fabulous prices and bonuses for the chance to get into the great monopoly. Now, in many places on the continent, I cannot say it is so in all, the market is free for all to bring in their wares, and sell for themselves, thus opening up healthy competition, and enabling both producer and consumer to be benefited.

I have suffered from these unjust regulations, and have known many others who have. Now this will continue until in all cities and towns the *free market* system is established.

It is time the community wakened up to their interests and agitated, and continued the agitation, until mayors, aldermen, councilmen, and all the dear office-seeking community find they can't be treated to their favorite seats unless pledged to agitate reform, and work and clamor for the free market system.

The Tribune, the friend of the farmer and the champion of the oppressed, could do no better service to us all than "set the ball rolling," until the required strength is attained to carry and establish the free market system, thus giving equality to all, so that the farmer might feel that he was not doing an injustice to himself and family by assisting Dame Nature to turn out from her fruitful womb the wealth of *luxuries* as well as *necessaries* of life, and that the consumer, be he the son of toil or the pampered son of wealth, would feel that in consuming the products of the soil he was not devouring gold dust at an extortionate price. It seems to me that a thorough agitation of this subject would be of more benefit to a larger class of mankind than the one of woman's rights and other kindred follies.

Mr. J. B. Lyman.—This writer comes near the root of the matter, but the remedy is a little deeper than he suggests. The agricultural interest and the farmers are less actively and less ably represented in all our legislatures than any other great interest. The railroad interest is always able, always vigilant, and backed with an unlimited bank account. So of corporation interests. Marketmen are agreed as to what they want, and promptly make up a purse to carry their measure. But the farmer is a little slow in legislation; he thinks more than he talks; and the farm interest seldom makes common cause and works for one thing. We want laws that especially affect farmers made by farmers, not by lawyers and lobbymen. But the farmer in order to hold his own, in legislation, must be wide-awake, adroit, and at times tonguey, in order to compete with this class of men, the evils of which Mr. Copeland complains will not be removed until the agricultural interest is championed by the best and ablest men in the community.

Cooking Food for Hogs.

Mr. M. K. Young, of Glen Haven, Grant county, Wisconsin, wrote as follows: "To your reply to Mr. Rodgers, of Lyons, Iowa, in relation to this subject, I except, and I can sustain my objection in fewer words by giving my own plan, probably, than in any other way. I use a *pan* instead of *kettle*, for economizing fuel, of the following dimensions and material: Four feet four inches long, twenty-six inches wide, five inches high; bottom of sheet iron; sides, two-inch hard maple, dove-tailed; top, inch pine boards, buttoned with strong wood screws. This pan is placed in an arch, with proper chimney draft, and from the lid a steam pipe enters a box upon the side, just above

the bottom boards. A false bottom, with inch auger holes two inches above said bottom boards, is used to allow the steam to act upon all parts of the contents of the box alike. A close lid placed upon the box before raising steam. This pan will cook a box of potatoes, holding twenty bushels, after the steam is up, in thirty minutes. I have timed it often. Indeed the process of cooking is so rapid that another important advantage results—the wood used for fuel is just completely charred, and upon the application of a little water, you have a nice lot of charcoal, enough for your hogs till more is made in steaming, to which, you know, hogs on high feed should at all times have access. Why does Mr. Rogers think of using water to make mush of his potatoes? Better feed the potatoes, when cooked, without any mashing or watering. The hog, though devoid of reason, can tell much better than Mr. Rogers how much water he wants with his potatoes. And why does Mr. Rogers think of a separate 'rig' for cooking meal? Or why think, rather of cooking meal at all? Why not steam his corn in the ear with his potatoes, and let the hog do his own shelling and grinding? I will guarantee that when the corn is steamed to the pulpy softness of the roasting ear, that the hog will make it available for less toll than the miller. In feeding the hog cooked potatoes, let me suggest to Mr. Rogers the mixing in this season of Hubbard squash, or sweet pumpkin, when he steams his potatoes. Then he has the sugar and the starch, and unless in very cold weather, the corn may be unground. This I suggest from but a very little different experience—the use of sweet apples. I might say that my rig has not cost me more than ninety cents a year. For thirteen years it has been used when the state of the pork and potatoe market indicated its use."

Mr. H. Wolcott, Genesee, N. Y.—As economy of time and fuel are of the first importance, I would suggest using a pan instead of a kettle, For the sides use one and one-half or two-inch planks for the bottom, and six inches in width. On the ends use sheet iron or zinc. If it is made four feet square, one foot in depth will hold ten bushels or more of roots, or twelve bushels of grain or meal. If meal alone was to be cooked, I don't know but a false bottom would be necessary, with perforated pipes to carry the steam into the meal. A trial could be made of using two inches of corn in the bottom, to prevent the meal sticking and burning, or make a partition so as to have the fire arch only a little more than half the width of the pan, passing the fire to the back end and returning it to the chimney on the opposite side from the arch, at the front end.

GAS LIME AS A FERTILIZER.

Prof. Jas. A. Whitney read the following paper on gas lime as a fertilizer: The use of gas lime for manurial purposes having led in different cases to totally opposite results, in some causing a great and immediate increase in the growth of grass and grain, and in others materially injuring the crop and impairing the fertility of the soil, a brief exposition of the nature of the material and the proper method of applying it will interest those desiring to test it. Gas lime is lime that has been used for abstracting sulphur and some empyreumatic substances from coal gas. It differs from ordinary slacked lime in this, that it contains sulphur and compounds of sulphur. Some of the products thus formed and mingled with the material are very hurtful to vegetation, while others may be judged to be somewhat beneficial in their action. As hereinafter more fully explained the hurtful compounds exist in the gas lime when fresh from the works, but by judicious management may be rendered harmless and even useful. According to the condition of the gas lime with reference to these impurities will it benefit crops or *vice versa*, and this may serve as a general explanation of the discrepancies in the various accounts of results derived from its use.

The lime used in gas works is obtained by calcining oyster shells, and forms a white pulverulent powder. In a large room provided for the purpose are arranged a number of rectangular wooden boxes, somewhere from four to six feet deep and between thirty and forty across. In these, a few inches apart, are placed horizontal slatted racks, upon each of which is spread a layer of the oyster shell lime two or three inches thick, the powdered condition of the lime making these layers porous so that the gas may filter through them. The gas generated by roasting bituminous coal in the retorts, is made to pass first through water where it deposits most of the ammoniacal matter and gas tar. It is then conducted into the lower parts of the boxes containing the lime as just described. The gas passes up in succession through the several layers of lime. This absorbs the free sulphur, sulphurous acid, and such like impurities, and the gas being purified by the removal of these substances, passes out through a pipe at the top of each box, and is conducted to the gasometer. The quantity of sulphurous impurities in the gas, and consequently of those taken up by the lime varies somewhat with the nature of the coal from which the gas is made, some coal containing more sulphur and some less, and this agains depends upon the locality from which

the coal is brought. For this reason an analysis of any particular sample can serve only as an approximate indication of the average composition of gas lime, but this is enough to enable general rules to be laid down sufficiently accurate for practical purposes.

When the lime in the racks has become so surcharged with sulphurous impurities from the gas that it can absorb no more it is taken out. This stage is ascertained by thrusting down into the box through a hole in the top a piece of moistened paper impregnated with acetate of lead. If the paper turns brown it is a sign that the lime has failed to abstract all the sulphur, and must be replaced by new material.

When taken from the racks the lime is found caked in greenish yellow masses, very porous and having a peculiar odor. According to an analysis made some years ago by Prof. Johnston, of lime from the gasworks of Edinburgh, the material when first taken from the racks contained about sixty-nine per cent of carbonate of lime; of caustic hydrate of lime, *i. e.* of quick lime combined with a certain proportion of water, about two and one half per cent; of sulphate of lime or gypsum seven and one-third per cent; sulphite and hyposulphite of lime two and one-fourth per cent; and of free sulphur upward of one per cent, the balance being made up of other substances of little account one way or the other. Now, of these materials embracing nearly the whole of the gas lime, the carbonate when applied to the soil would serve the same purpose as ordinary air slaked lime. The The hydrate was of common water slaked, and the sulphate that of gypsum or plaster. None of these could, in themselves, produce the injurious effects ascribed in many instances to the use of gas lime and the sulphite and hyposulphite must, therefore, be charged with the damage. Both of these substances are very soluble in water. When gas lime is applied to young and tender vegetation, the rain washes the sulphite and hyposulphite into the ground in such quantity that their action destroys the vitality of the plants, and while remaining unneutralized the soil will deteriorate its productive powers. Prof. Johnston also analyzed samples of the same material after exposure to the weather for a considerable time and found that the free sulphur, sulphites and hyposulphites had disappeared while the proportion of the sulphate or gypsum had quadrupled. This result occurs from the gradual oxydation of the three substances first named, their consequent formation of an additional proportion of sulphuric acid and the combination of the latter with lime to form a sulphate. This change is apparently

analagous to that by which iron pyrites or sulphuret of iron is made to yield copperas, the sulphur and iron both oxydizing, the one to form sulphuric acid, the other to constitute basic oxyd of iron, and these two products uniting to form sulphate of iron or copperas. It will be seen that when the removal of the injurious constituents has thus been secured it is brought into the condition simply of an impure carbonate of lime, and may be applied in the same manner. To bring it to this state it must be exposed to air and moisture. This can be done by leaving it for a few months or weeks in piles under open sheds, which is the better way, or by applying it in the autumn and leaving it upon the surface until spring. If the latter course is followed, probably as much as seventy or eighty bushels to the acre could be applied without mischief, but if one-third of the same quantity of the raw or fresh material were applied in the spring it would be likely to kill the young plants, and would on some varieties of seeds prevent germination. As regards the old or prepared material it is somewhat milder than ordinary slaked lime, and thirty bushels per acre applied in the spring would be an average standard for its use. It is believed to be the most beneficial to old and tough sward, to orchards and potatoes. Its peculiar odor, arising from the presence of a very small proportion of tarry matter, gives it a certain efficacy in repelling insects, worms, etc., and for this reason strewn sparingly over young turnip plants or harrowed in before sewing, its use is preferred in some cases in England to that of common lime. On mossy lands and those recently reclaimed by draining in the amelioration of muck, etc., gas lime, after due exposure to the atmosphere, may be used in the same manner as common lime.

The disappointment experienced in attempting the use of gas lime as a fertilizer has arisen for the most part from the exaggerated claims that have been made in its favor and the crude directions given for its application. We need not refer further to the need of removing the sulphites by continued exposure to the air, but a few words should be directed to the statements made in the circulars of those interested in its sale, that "it may be mixed at once with barn yard manure and stable manure, expelling none of the valuable gases, but fixing and retaining them fully equal to plaster." Old gas lime, as shown by Prof. Johnston's analysis, of which mention is made, may contain some thirty per cent of sulphate of lime or gypsum, which by itself would be capable of fixing a proportion of

ammonia, but inasmuch as it is mingled with more than twice its weight of powdered carbonate, the whole, if mixed with fermenting manures, would do mischief, and although this result, weight for weight, would be less marked than if ordinary lime were used, the experiment cannot be carried out without the loss of a portion of the more valuable constituents of the manure.

In conclusion the writer would express the opinion that all things considered, gas lime, properly managed and applied, is equal in value to common air slaked lime, with the additional advantage, whether that amounts to more or less in practice, that it has a tendency to repel insects. It is not likely that its use will ever become very extended for the reason that the supply is limited, and by the introduction of new methods of purifying gas will probably become less instead of greater. The annual production in New York and Brooklyn was estimated, by a dealer, at three quarters of a million bushels, which is one-fourth less than it was a few years ago, one of the large gas companies having recently adopted another process of purification.

Adjourned.

September 7, 1869.

NATHAN C. ELY, Esq., in the chair; the Secretary absent, being at the exhibition of the Institute.

SMUT IN WHEAT.

Mr. P. J. Hyde, Sudbury, Rutland county, Vermont.—A. S. Witter wants a sure method of preventing smut in wheat. Here is what I do and never raise smut; soak my seed in brine twelve hours, have brine enough to cover the wheat, drain off the brine and roll it in strong slaked lime.

Mr. J. W. Gregory.—That remedy was used with success fifty years ago in England, except that human urine was used in place of brine.

An English gentleman.—In Cornwall the same preventive of smut is now used with success.

Mr. J. B. Lyman.—English chemists many years ago discovered that the health and vigor of plants is promoted by soaking the seed in a weak dilution of sulphuric acid. This is recommended as a substitute for the animal acid alluded to. Smut is a disease of wheat that is not understood any more than consumption is in the human

race. But we know, in a general way, that a regimen that produces a vigorous and cheerful growth is the best preventive. Some farmers have special treatment, the secret of which they will impart upon application ; witness the following from

George S. Smith, Burlington, N. J.—I read the report of the Farmers' Club with the greatest pleasure and profit. I read an article by George Geddes about smut in wheat ; he did not give a sure preventive in all cases. I am ready and willing to send a recipe to any one who will address me. I care not if the wheat is half smut, by this process I can sow it and there will not be a head of smut in the growing crop. It is simple and easily applied. I have tried it for the last twenty years, and never saw a bit of smut in the wheat that had been dressed, no matter how much smut there was in the seed. I am willing to risk $1,000 that my recipe is unfailing with wheat that is a third smut.

Mr. Oliver P. Stingill, Rumford, Oxford county, Me.—I think the prime cause of smut in wheat is the spoiling of seed by either heating moulding or sweating of the wheat in the stack, mow, or bin, after it is harvested and before it is sown again. I think wheat used for seed, if entirely free of the disease called smut, will not produce smutty wheat from any condition of the atmosphere or soil. If the above conclusions are correct we shall readily come to the opinion that, to prevent the growth of smut in wheat, we must take particular care in harvesting our wheat for seed. We should have it well ripened and dried before it is put in the barn and grainery, and see that it is kept free from damp, mould or smutty wheat. It is evident that smut will propagate smut by contagion when mixed with the wheat and sown together. Hence some of the remedies recommended will be found very useful in checking or preventing the disease or fungus when smutty or damaged wheat is sown. But the sure way is to sow wheat that is entirely sound, free of all damp, mould or damage, and all contagion of smutty wheat. Some twenty-five years ago I was engaged in grinding wheat, and was much troubled with smutty wheat. One of my patrons always brought me clean wheat free of smut, and his neighbor always raised wheat more or less smutty on the same kind of land, their farms adjoining. Noting this fact, I asked the first named how he managed to grow wheat free of smut and his neighbor smutty wheat. He said his practice was to cut his wheat when ripe and shook it in the field until dry ; then put it in the barn, where it would keep and remain

dry until threshed and used for seed. I have conversed with many wheat growers, and have raised wheat some fifteen years, and all my observations and inquiries have led me to the above conclusions.

Mr. George W. Ames, of Union county, Oregon, says: Let those who are pestered with smut in wheat soak their seed in vitriol. To every five bushels dissolve one pound of vitriol in enough water to thoroughly saturate the wheat, and let it stand over night, or twelve hours, before sowing. When I came here, in 1862, my neighbors told me I must vitriol my wheat before sowing, to prevent smut. I did so, and had a good crop. Thinking, perhaps, that was labor and expense for nothing, the next year I sowed a small patch in the midst of my field without vitrioling it, and it was at least one-third smut, while the rest of the field was clear wheat. My nearest neighbor was unable one year to procure vitriol in time, and, being a little skeptical about its virtue, sowed without. The result was about one-third smut. The next season, to give it a more thorough test, he sowed a small strip in the midst of his field without vitriol, and it was half smut.

Is the Tomato Worm Poisonous.

Mr. Jonathan Askham, Phelps, N. Y., has seen it stated in a Rochester paper that the tomato worm is poisonous; that it is capable of ejecting virus from its mouth a distance of several inches; and the same journal, he says, cites one or two cases where this virus, coming in contact with an abrasion of the skin, produced fatal results.

Mr. John Crane.—The worms are the same species that infest tobacco plants. I have caught thousands and suffered no harm. Turkeys eat them and grow fat on the diet.

Mr. Thomas Cavanagh.—If they are the same as are found on celery and parsley, they are to be avoided. I have known persons to suffer considerably for a number of days from having come in contact with these.

Mr. D. B. Bruen.—The tomato and potato worm are alike, and not dangerous, I think, though they will destroy the foliage of the plants.

Mr. A. S. Fuller.—The tomato worm is perfectly harmless. I have heard the stories to which our correspondent alludes, and can understand how it may have happened. I have known persons to be poisoned by the prick of a pin, and I heard recently of a lady who was poisoned by a rose geranium; yet no one will say that either of these things are dangerous. Simple herbs may poison one, and yet be handled by another with impunity.

THE SUGAR MAPLE.

Mr. Louis Jackson, of Rockford, Illinois, desires information as to the proper time to plant the seed, and how it should be treated; in short, all about it.

Mr. A. S. Fuller, (Author of "The Forest Tree Culturist").—I have raised a good many hundred thousand sugar maples. The process is simple. Take the seed in October; mix with moist sand; bury the box containing this mixture, and next spring sow in drills two and a half feet apart—placing seeds about two inches distant. Keep the rows clean and remove to the nursery in the fall or the following spring, cutting of tap-root.

CONCERNING COTTON WOOD.

Mr. J. F. Simonds, of Iowa Falls, Iowa, made inquiry about this tree, when to set the cuttings, &c.

Mr. A. S. Fuller.—Set the cuttings in spring.

Mr. Solon Robinson.—What does he want to grow cotton-wood for? There are enough better sorts. Locust, for instance, grows with equal rapidity, and it grows tall, too, and quick. Why in Indiana I planted some locust seed, and the trees are very large now and I hope you don't call me old.

THE WHITE WILLOW.

The correspondent last named forwards the following: Some of your western readers who have seen miles of white willow hedges which will turn any kind of stock, from a rabbit to an elephant, are sometimes amused by the debates in your Club upon the willow, for hedging, and the wise predictions or unfounded statements of its failure. The truth is, that any one who will set a row of white willow cuttings and cultivate for three years with the same judgement and care and skill which he would give to a row of corn, can have a fence the fourth or fifth year which will turn any stock ever kept upon a farm. I have no cuttings to sell.

SAW-DUST AS A FERTILIZER.

Mr. Simon K. Dow, of Concord, N. H., wrote to say that he has a pond in which saw-dust (from a mill above) has been accumulating for the past twenty years, and now it is of the depth of three or four feet. The pond is usually dry during the summer months, and he has bethought him that possibly this deposit, used as a manure, would benefit a hard soil, formed principally from the

detritus of the granite. "If so, in which way, gentlemen, ought it to be applied, and when ?"

Mr. A. S. Fuller.—Compost it with lime, or use as litter in the barn-yard. If spread on the land this fall it probably would be fit to plow under next spring.

Mr. J. B. Lyman.—The value must depend on the character of the wood. If hemlock, or other resinous variety, it is not of much consequence, unless for its mechanical effects. A saw-dust decayed must be judged by the value of the same wood in the ash. Oak, beech, and maple ash is worth five or six times as much for manure as the ash of pine, and is much better than hemlock. If Mr. Dow's saw-dust is mostly from hard wood it will by all means pay to cart it out and compost it—if mostly hemlock it may pay, but his hopes must not be sanguine.

Mr. A. S. Fuller.—If his soil is hard, might it not pay for its mechanical effect ?

Mr. J. B. Lyman.—Yes, if the distance is moderate.

Snails.

Mr. H. W. Smith, of Clearfield, Pa., wrote as follows: I have been greatly vexed with snails in my garden this year, and expect (unless you can give relief), to be unable to raise anything next year. Also, whenever my egg plants attain the size of a walnut, some pest eats into the heart of the stem, and off goes the fruit. When there is no fruit they cut off the plant. This may be the snails also. Now, will your delightful society give me some information on the subject tending to relief, for which I will be ever grateful.

Mr. Solon Robinson.—Let our complimentary correspondent endure a drought. A friend of mine in New Jersey says this did the business for him.

Mr. A. S. Fuller.—Scatter fresh-slacked lime in the places where the pests most do congregate. We had them in Brooklyn once, and the annoyance was very great.

Mr. Solon Robinson.—I was not aware before, Mr. Chairman, that they ever had anything as slow as snails in the city of churches.

Mr. A. S. Fuller.—The snails spoken of were not indigenous to the soil, but were imported with certain shrubbery from France.

Clover on Prairie Land.

Mr. Louis Jackson, Rockford, Ill.—Gentlemen of the Club: What kind of manure should be used with clover sod for the production

of a good yield of grain? We obtain a fine growth of plant, but neither wheat or corn ears satisfactorily. The straw of wheat is apt to be weak and fall, and holds green after the grain is hard. This is the experience of several years on our prairies. Your weekly meetings are benefiting tens of thousands of whom you never hear. Allow me to state here, emphatically, that the man who propagated and gave us the Wilson Albany Seedling Strawberry, perpetrated an inestimable blessing on the people of these latitudes.

Mr. J. B. Lyman.—For a general answer I say—plaster. Let him stimulate and thicken his clover with a top dressing of gypsum, and plow under a sward that had all the lime it wanted while it was growing. Clover has given the best returns as a fertilizer when plowed under in soils well supplied with lime, as, for example, on the crumbling green shales of western New York. A prairie soil has abundance of potash, and the mild acids formed by vegetable decay. But the supply of phosphoric acid, or phosphate of lime, must be small, because this is generally of animal origin. Mr. Jackson should use concentrated animal manures, not so much barn compost, because they contain a great deal of carbon, that is of dried grass and potash, of which there is enough on the soil now. If he can buy in Chicago a ton or more of good honest bone-dust, that and plaster will prove the wisest purchase he can make.

September 14, 1869.

Nathan C. Ely, Esq., in the chair.

Influence of Certain Trees on Crops.

Mr. E. B. Seelye, Hudson, Mich., says, in his opinion, rust in wheat is produced by the barberry bush.

Dr. Isaac P. Trimble.—This is an old tradition that I heard from a boy, but there is no foundation for the belief. I have noticed, however, that potatoes in the shade of the black walnut never produce well. The influence extends to some distance beyond the earth penetrated by the roots of the walnut, and is one of those anomalies in agriculture which farmers observe and hand down by tradition, but cannot explain. But this old story about the connection of barberry with rust in wheat is without foundation in fact. Rust is produced by another class of causes.

Mr. S. Edwards Todd.—I am of the same opinion, but I know

there are hundreds of farmers who have a prejudice against the barberry on this account. But I have seen the finest crops of wheat growing close beside the bush spoken of.

Smut in Wheat.

Mr. J. M. Burton, of Newcastle, Penn., alluding to the article of Mr. Geddes, says: For each bushel take one ounce of blue vitriol, and with the solution of it moisten the wheat. The water in which the blue vitriol is dissolved should be thrown boiling hot on the wheat, and the pile stirred constantly. One who has applied this will not go back to the salt and brine preparation.

How to Prepare Peaches for Preserving.

Dr. Joseph Treat, Vineland, N. J.—Never pare peaches to dry. Let them get mellow enough to be in a good eating condition, put them in boiling water for a minute or two, and the skins will come off like a charm. Let them be in the water long enough, but no longer. The gain is at least six-fold—saving of time in removing the skin, great saving of the peach, part of the peach saved the best part, less time to stone the peaches, less time to dry them, and better when dried. A whole bushel can be done in a boiler at once, and then the water turned off. This very morning we had over two bushels skinned, stoned (halved) and on the boards long before a quarter of them could even have been peeled.

Dr. Isaac P. Trimble.—There is sense in it. I have known the plan practiced often, and it works well.

Bots in Horses.

Mr. T. S. O'Bannon, Newark, Ohio, writes as follows: "I would utter my humble protest against the opinions of I. P. Trimble and J. A. Whitney, in regards to the disease called bots in horses. The eggs which produce bots are deposited on the horse by two kinds of flies. One deposits its eggs mainly near the knee, on the legs, but some eggs promiscuously over the horse. The other deposits its eggs under the jaw, near the throat, and never anywhere else. In close observation by myself and others for a long period, there never has been detected a single exception to this rule. The two flies are distinct, one from the other, and the bots from them occupy different positions in the stomach. I would go on and give more particulars of these flies, but that is foreign to the purpose for which this letter is written. There is no such disease as bots in horses. They live in

the stomach and hook fast to the coatings, as Mr. Trimble says. But they have no means of biting or eating, but live by suction alone. Mr. Whitney says a cure is very difficult but not impossible. Bots in their attack produce symptoms as of colic, &c. Now a careful observer will notice in taking out the stomach that the bots, with the exception of a few, are fast in clusters close together in their original position (hooked fast in the coatings of the stomach—not hooked fast by any sudden or recent puncture, perforating the flesh, but actually growing fast) and that under those clusters the coating of the stomach is seemingly healthy and unchanged. If this is the case, do not the bots absorb the poisonous acids at that point? The stomach being much eaten away by the impure action of the acids, or otherwise, some few of the bots become loosened; sometimes a dozen or more, and rolling about with the food seemingly helpless. These must be the bots that eat the horse, as I am sure the others do not and cannot. In many cases the quantity eaten amounts to several pounds, or twenty times the weight of the bots thus loosened. Voracious creatures, eating twenty times their weight in thirty minutes. No wonder Mr. Whitney says you must be quick. If you want to cure this supposed disease, give such medicines as will cure inflammation of the stomach, bowels, &c. I have relieved them often with a decoction of common or sage tea well sweetened. The doctors here claim there is no such disease as bots, and as doctors agree, I have had the impression that the community at large held the same opinion until reading the remarks of members of your club. I have had an experience of over forty years; in that time I have cured many and killed as many horses with the supposed disease. May I be forgiven for the many nauseous doses I have improperly prescribed. It may be that we live too far West, and are not up to the times. If so, we will listen with patience. But be assured we will not, without some cogent reason, believe in this bot disease any more than your argument in favor of shallow plowing.

Mr. George B. Wood, Hamilton, N. Y.—I read with interest and profit the facts published in your Club reports to the inquirer respecting bots in horses. I would corroborate Mr. Whitney's remarks as to feeding potatoes as a sure preventive, from an experience and observation of twenty-five years. I would also say, leave the milk and molasses and white oak bark medicine out of the question, as being frequently beyond reach in a severe attack. But take potatoes,

which are always at hand, and pound up sufficient quantity and put them in a strong cloth to strain out a quart of clear juice; roll the horse fairly on his back and pour the juice down him and hold him on his back from three to five minutes, release him and in ten minutes he will commence to eat. Every one versed in the habits of bots knows they hook in the upper part of the stomach, hence the necessity of placing the horse on his back. This remedy has never been known to fail in the last stages of the most severe cases.

Mr. David Kinch, Altoona, Blair county, Penn.—For the benefit of James Little and other inquirers for "bots" in horses, I will state the cure which obtains most in this vicinity is the following, viz.: Bleed the animal in the neck (open the jugular vein), take half a gallon of blood, drench it with the blood, in a half hour follow with one pint of sweet oil. With me it is considered a "dead shot" for bots in horses. Now for the philosophy of the cure as I understand it. The stomach having become morbid and particularly sour, by a change of feed, for instance, from cut feed to whole corn, with a full drink of water before feeding, which renders the contents of the stomach distasteful to the bot, it quits feeding on the contents, seizes the stomach to get something sweet and salt, which is blood. Put that into the stomach in quantity sufficient to correct the morbidness, and they will let go of the stomach, suck themselves full almost to bursting, at which time put in the sweet oil, which penetrates them from the surface and makes a complete "spread eagle" of them.

Mr. W. H. Hatch, Jr., Cornish, N. Y., writes that a friend of his "has seen two horses relieved of bots by giving to each a pint of indigo dye as a dose," and H. M., of Canyon City, C. T., says: "Tell that Sing Sing man that one and a half or two ounces of laudanum saved a horse for me that was badly off for bots. I got the receipt from an Illinois teamster."

Mr. A. B. Crandell.—Youatt, in his book about horses, gives facts concerning the origin and habits of the bot, which agree, for the most part, with the statements made at a previous meeting. Youatt also says some things which may be surprising to certain of our correspondents. For example, he announces, in effect, that the bots cannot, while they inhabit the stomach of the horse, give the animal any pain, for they are fastened on the cuticular or insensible coat. They cannot stimulate the stomach and increase its digestive power, for they are not on the digestive portion of the stomach. They cannot, by their roughness, assist the trituration of rubbing

down of the food, for no such office is performed in that part of the stomach, the food being softened and not rubbed down. They cannot be injurious to the horse, for he enjoys the most perfect health when the cuticular part of his stomach is filled with them, and their presence is often not even suspected. They cannot be removed by medicine, because they are not in that part of the stomach to which medicine is usually conveyed, and if they were, their mouths are too deeply buried in the mucus for any medicine that can be safely administered to effect them; and, last of all, in the natural course of things, they detach themselves and come away. "Therefore," concludes Youatt, "the wise man will leave them to themselves." Stonehenge, the English authority, holds the same opinions, and, on the last named point, he says emphatically: "No medicine is known which will kill the larvæ without danger to the horse," and he counsels the groom to be not meddlesome, but patient, and avoid any attempt to hasten the expulsion, which, in due time, never fails to occur.

Large Lambs and How to Raise Them.

Mr. John Floyd, Green Springs, Ohio, inquired how to raise such large, nice lambs, as he had seen reported in the New York papers, some of which, he writes, weigh from fifty to sixty pounds each. I know, he says, that many hundreds of ewes are purchased in this locality, taken to New Jersey or near New York for the purpose of rearing early lambs. But how they manage to feed the lambs of our small ewes to such a weight, so early in the season, is what we want to know. Will some member of the Club tell us what to do, and how to do it?

Mr. S. E. Todd.—Perhaps this question may be answered satisfactorily by relating a bit of my own experience. My father once separated a lot of old cull ewes from his flock and turned them into the highway, saying that they might go to grass, as they were worthless to him. As I had no sheep, I proposed to take them and rear some lambs. But he remonstrated against the suggestion, saying that I could do nothing with them, as they were too old and poor. Beside that, he suggestod I had no turnips. Therefore, it would be the hight of folly for me to attempt to rear lambs from such sheep. But as my fields furnished an abundance of pasture at that time, I ventured to disregard the counsel. So I took pity on the old ewes, and turned them into my pasture late in July. Then I employed a a man to help me two days to snake off the logs and burn the brush

on a piece of new ground, where turnip seed was sowed. And a bountiful crop was ready to harvest in November. Before the end of the growing season these old sheep were in a thrifty condition, and would have made far better mutton than thousands of sheep that are received at the New York markets every week. About the 1st of November, one of my father's thoroughbred South Downs was borrowed for a few days, the result of which was that, about the first week of the succeeding April, every ewe had by her side a large and strong lamb showing a liberal infusion of the South Down blood. And some of the ewes reared twins. At the last of June those lambs weighed forty to sixty pounds per head. And I sold them to a tricky butcher, who, by the way, has not paid for them to this day. During the winter those ewes had the advantage of a spacious and comfortable shed from the close of the growing season until the next summer. And they lost not a single lamb, although the period of weaning occurred in cold and stormy weather. During the foddering season this little flock received a feeding of a few turnips daily, in addition to hay in the morning, all the straw they would eat during the day, and a supply of cut corn-stalks at evening, with access to water at all times. The only secret of producing good lambs from ewes of a medium size is to cross them with a thoroughbred South Down, Hampshire Down, Cotswold, or Leicester, and give them proper care. Sheep must have a supply of turnips during the fodder season to give tone to their health.

A Shallow Plower.

Mr. J. E. Vaughan, Wyalasing, Bradford county, Pa., is convinced of it, and gave his experience and ideas as follows: Commenced farming for self five years ago last spring. Have been an interested reader of the reports of your Club for years, and follow farming for the pleasure as well as the profits, which is sure to accompany thorough systematized operations. I commenced as an advocate of deep tillage, but have learned from *experience* that it is *not* the thing for our soil here in northern Pennsylvania, for I can and have raised at least one-third more grain, especially corn, other things being equal, acre for acre, from land plowed only three or four inches deep, than I possibly could from land plowed twice as deep; besides, deep plowing proves not only a temporary but a permanent injury to our land. Farmers want to think as well as act, and I tell you it don't do to plow so deep that the turf, which in decomposing should fur-

nish food for the young plant, is virtually embalmed. A little observation will satisfy any one on this point. In any wooded country there are more or less "cradle knolls," especially on new land, and vegetation, no matter of what kind, is much less on those than it is elsewhere. But I think that it is impossible to establish a uniform rule. Plowing should vary somewhat according to circumstances.

Dr. Isaac P. Trimble.—That letter, Mr. Chairman, is, in my estimation, more valuable than anything Mr. Fuller has said here on the same subject for ten years. I am going to take the pains to write out something which will, I hope, have influence in saving the people from this sad and harmful delusion of plowing deep.

GROUND HAY FOR CATTLE FEED.

Mr. Joseph S. Kirk, Pittsburg, Pa., writes: "For some time past I have been making observations and experiments in animals' food, and obtaining what I believe to be an improvement, and I take the liberty of communicating to your Club the results. Grass being the natural food for live stock, it is easily and properly masticated, and as a consequence, its nutrition is easily extracted. With hay, however, the case is different, for when fed in sufficient quantities the animal, especially if its teeth have become flattened by age, attempts to satisfy itself by selecting the leaves and tender branches to obviate this difficulty, and prevent waste. Cutting hay in short lengths has, to an extent, become general, and is, no doubt, a step in the right direction. My belief is, that we should go still further, and grind the hay as we now grind oats and corn. It is thought that owing to its glutinous nature, hay could not be reduced to a state of meal; or, if so reduced, the expense attending would not justify. To test this I constructed a cutter and crusher on new principles, and the result was beyond my most sanguine expectations. Ten tons a day can be ground with one machine, at a cost not to exceed one dollar per ton. Ground in this manner hay is not unlike ground oats, save in color, its weight being from thirty-two to thirty-six lbs. per bushel. Mixed with chapped feed, such as corn or oats, it makes a cheap and excellent food. Thus we effect by mechanical means what the hard-working or decrepid animal is incapable of doing, perfect mastication.

LIME FOR WHITEWASHING.

Mr. J. B. Saunders, Flora, Ill.—An opinion prevails that air-slaked lime is not as good for whitewashing purposes as water-slaked. Is

this correct? What is the chemical difference, or is there any, between water-slaked lime and air-slaked? When stumps, roots, leaves, &c., are burned, will the ashes from them be as rich in fertilizing qualities as if they were allowed to gradually decay? And will not the ashes of burned weeds make as good a manure as the remains of the same when they decompose? What is the cheapest and best remedy to purify cistern water, and keept it from stagnating or smelling in warm weather? This is important to many. I have seen permanganese of potash recommended, in the proportion of one ounce to fifty gallons of water. But as it sells here for two dollars per pound, it is too dear for the purpose. In an agricultural paper I saw alum recommended, but would not that be unhealthy? Would chloride of lime answer? Please reply to the above in detail, as they are of universal interest.

Prof. Jas. A. Whitney.—When stone or caustic lime is treated with water, a definite portion of lime unites chemically with a definite portion of water, and forms hydrate of lime. When stone lime is exposed simply to the atmosphere, it absorbs both water and carbonic acid, which converts it into a mixture of hydrate with the carbonate of lime, the latter being of a very different nature from the former, which accounts for its inferior value for whitewashing purposes. Stumps, roots and weeds had better be burned and the ashes used for fertilizers, but leaves are such excellent materials for a compost heap that they ought never to be used for any other purpose. It is impossible to say whether the ashes from a given quantity of vegetable matter would yield as much available manure to a soil as the same material more finely divided by the process of decay. In practice the results would vary much with the character of the soil. In a soil deficient in humus, the rotting vegetable substance would assist the retention of ammonia and do good. On ground of a different kind, a reclaimed bog, for example, it would only tend to make a soil, already too loose, still more so, and would do harm. The only trustworthy method of purifying cistern water is by filtering it through some substance like charcoal. The use of permanganate of potassa is highly recommended, but it is probably too costly for the correspondent, although an inferior quality sells for much less than two dollars a pound in New York city. Alum will do little or no good; it will spoil the water for all domestic uses. Chloride of lime would not answer to put in the cistern, but it might be spread upon the ground around it, to destroy the odor from the stagnant water.

The Eumelan Grape.

Several clusters of this variety were sent by Messrs. Hasbrouck & Bushnell, who bought the vineyard of Dr. Grant, Iona Island, N. Y. Upon distribution, the testimony was general as to the pleasant flavor and fine boquet of this grape, and Dr. Hexamer said he regarded it as one of the most promising of the new varieties. It has fine qualities, the vine does not mildew, and it has been thoroughly tested before being offered to the public.

Mr. S. E. Todd.—People may, in my opinion, plant the Eumelan with much confidence. I have watched it for a year or more, and think it the best of the black grapes.

Onion Culture.

Mr. Edward Develin, Norfolk, Va.—Please inform me: First, how shall I best preserve onion sets, after curing them on a loft? Second, can I raise onions for a private family during the winter, in this mild climate, and, if I can, how? and I shall appreciate the favor.

Mr. S. M. Wells, Wethersfield, Conn.—After the onion sets are cured they should be put into clean barrels, the barrels to have holes made in the sides and ends for ventilation, and be placed on the sides in a cool, dry place. They should not be allowed to freeze. By this method we always bring them through in a sound condition. Second, the bulbs will not form, or to use a local phrase, they will not bottom. It would make your eyes water to see the crop of onions and onion seed we are now harvesting. "Our way" has succeeded well again this season, bringing a very uniform yield on all the gardens.

There is no reason why the onion should not grow well through the latter part of a southern winter as mild as at Norfolk. It is a plant that thrives best in the moisture of a growing spring time. The intense heat of midsummer should not fall upon young plants. The earth should be so rich and so mellow that the growth will be rapid. With me the month of June determines the yield of my beds, but the critical time for bulbs and seed is August.

Coal Tar for Plum Trees.

Mr. William Barnes, Rives, N. Y.—I saw a discussion last winter on the plum culture, and one of your honorable body rehearsed an instance of some one building a lean-to on the side of his house, and pitching the roof with coal tar. Near by stood a plum tree, which had not borne for some time. That year it hung full, and he thought

it was in consequence of the coal tar being offensive to the fly, and wished some one to try the experiment of tarring some boards and placing them in the trees. I have done so, and the result is, my trees have all the plums they ought to stand under, when for several years they have been of no account, and I had threatened to cut them down. I took a rough board, about six or eight feet long, nailed it to a pole of sufficient length for the tree, and running it up by the side of the trunk, fastened it there with cords. I did not put mine up quite soon enough; the plums were about half the size of peas. I saw some of them had been stung. They ought to be put up when the tree is in bloom, and I would recommend once in two or three weeks for a few times to repeat the process, and tar them over again. My neighbors tell me their plums have all fallen off. They have not tried the plan. I read the discussions of the club with great pleasure and interest.

Fruit Kiln.

Mr. W. B. Lyons, Vineland, N. J.—Will the Club please give information in regard to the proper construction of a house for drying fruit. I have just built one, but it does not answer the purpose; it is four by six feet inside, six feet high, racks eight inches apart, with ventilators on top, and heat with a small stove. The fruit does not dry evenly. Are my racks too close, and does it need more and side ventilation? Any instruction you can give will be thankfully received.

Mr. J. B. Lyman.—The cheapest fruit kiln is made by building a small house over a rude brick or stone arch, the door and the chimney of which are both outside the walls of the house. In this way the heat is uniform, and continues many hours after the fire goes out. In Tennessee and Virginia, where a great many peaches are dried, this arrangement is usual. Yet it is inferior to the close chamber, so arranged as to receive and discharge a current of hot air. With a stove the better plan would be to heat the chamber with the stove-pipe, the door of the stove being in, without the chamber.

The Coffee Tree for Forest Culture.

Mr. Jefferson Bartlett, Marshfield, Warren county, Penn.—Some time ago I saw a discussion on the subject of cultivating timber, and there appeared to be a query what kind to plant that would be most lasting. Some suggested black walnut, some chestnut, some

one kind, some another. Well, gentlemen, I am a man sixty-six years old; I was born and raised in Virginia, and have been familiar with all kinds of timber, and their uses, and if I was to plant timber to raise for durability, I would go in for a good chance of coffee nut, or coffee bean, just as you please to have it. Locust is liable to be injured by the borers; chestnut will not last on the ground or in it; cedar is too slow a growth, and too dwarfish; coffee nut grows thrifty and tall, and will last as a post for twenty years or more. I have now got posts set around my yard that have been in use twelve years, and there is no sign of their rotting yet; indeed, the sap is not clotted; and I have noticed stumps within the last few days, where the land has been cleared upward of twenty years, that were perfectly sound. The tree is very comely to look at, and it bears seed plentifully. I have a quart or half a gallon of the nuts that I gathered this last spring, that I will forward to any person who will signify their wish to obtain them, if they will be at the expense of charges for expressage, and tell me how to send them.

AMERICAN SUMAC.

Mr. C. W. Burnett, of Cabel Court House, West Virginia, writes as follows: I saw in the *American Farmer*, of Baltimore, Md., of May last, a statement about American sumac as a tannin principle. It says: "A lot of sumac has been sent from Philadelphia to Liverpool. It has been analyzed by Hudson & Arrott, and found to contain twenty per cent of tannin." We have immense quantities of sumac in this region. I suppose it must be the same as sent from Philadelphia to Liverpool. Some persons say there are two or more kinds of sumac. I have never seen but one. I see it is used for tannin, for coloring matter, and for urine. I wish to know what part of the tree is used for tannin. Is it the leaf or the berry, or both together, that's wanted; and how is it put up for market; is it injured by rain or dampness? I have seen in some papers that sumac is quoted as high as $190 per ton for Sicily, and in a Baltimore circular of May, 1869, for roots, is quoted, sumac, ground, per ton, $35. Is anything doing in the way of sumac now-a-days? I would like to be informed on this subject. If it will pay, a company will be formed here to go into the business.

Mr. B. R. Lummis, Sodus Point, Wayne county, N. Y., also asks questions in relation to the same subject and particularly as to the worth of the seeds as a dye.

Professor James A. Whitney.—The value of sumac for tanning and dyeing purposes, especially for the first, is very great, but for wine it don't amount to much. It is very doubtful if the average of American sumac will yield ten per cent of tannin, let alone twenty per cent; eighteen per cent is the amount commonly claimed for Sicily sumac. The material is composed of the leaves and twigs, cut off and dried in the sun, and ground in mills constructed for the purpose. It must not be allowed to get damp or moldy. It is mostly used for tanning morocco, and until within a few years since most of that used in this country was imported from abroad, but ten or a dozen years ago the business was started in Virginia and has been increasing ever since. One manufacturer grinds and sells 600 tons per annum. A part of this is sent to Europe. Where it grows naturally in abundance its preparation for market ought to prove profitable. The same may be said of quercitron, which is used for similar purposes, and is made from the inner bark of the black oak. As regards the seed it cannot be counted of consequence as a dye.

Blackberry Wine.

Mrs. Bernice J. Kysor, Howard, N. Y., having seen an inquiry at our session held on the 13th of July, how to make blackberry wine, sends the following recipe: Measure your berries and bruise them; to every gallon add one quart of boiling water. Let the mixture stand twenty-four hours, stirring occasionally; then strain off the liquor into a cask; to every gallon add two pounds of sugar, cork tight, and let it stand until the following October, and you will have wine ready for use without further labor.

Mrs. H. W. Featherston, Union, Jackson county, Iowa.—Learned savans, I send you my mode of making blackberry syrup. Take the high bush blackberries, set them over a moderate fire, let them simmer until they break to pieces, then strain them through a flannel jelly-bag. To each pint of juice allow one pound of white sugar, half an ounce of cinnamon, quarter of an ouce of mace, two teaspoonsful of cloves, powdered fine. Boil fifteen minutes, strain, and when cool add to each pint of syrup a wine-glass of good French brandy. Bottle, cork, seal tight, keep in a cool place.

Mr. J. Warr, Chicago, Cook county, Illinois.—I would recommend those persons who have more berries than they can dispose of, when gathered, to dry them, and I think they can find an excellent market here in Chicago. They are retailing here for thirty-five cents per

pound. I should not have made these remarks, but I do hate to see any one recommending wine-making for it invariably leads to drinkng.

SOILING IN SUMMER.

Mr. B. F. Pease, Trumansburgh, N. Y., lives a mile from the village, has a farm of fifty-five acres, worth say $150 per acre. He can keep through the winter about eight head of fine grown cattle, and now he would very much like to know if he can gain anything by soiling in summer instead of pasturing. His land is well adapted to corn, oats, barley, wheat, clover and timothy.

Mr. J. B. Lyman.—If Mr. Pease has fifty-five acres on that admirable body of land between Cayuga and Seneca lakes, he has enough to give him a good living and to educate his sons at Cornell. But he must make it carry more than eight head of neat stock. I don't know a stock man or a milkman anywhere who ever became a convert to the evangelism of green soiling and went back to the beggarly elements of empty stables, little manure heaps, scrawny cows, dull horses, close bit pastures, and a dubious name at the county bank on discount days. But to green soil aright, Mr. Pease must be fixed for it. He must be duly penetrated with the homely but pertinent truth that the liquid excrement of a cow in one day, all saved and mixed with peat and charcoal or rotted sawdust, will grow grass or corn or beets enough to feed the cow two days. Make your stable floor water-tight, with tongue and groove stuff, or with tar concrete. Have a big pile of peat or rotton turf, or sawdust; throw it every morning, when Mrs. Cow is taking the air, into a gutter behind her stall. In fly time let her stable be dark and cool and clean, and give her a fragant handful of green corn, or a big lock of clover to smell of while chewing her cud. The more she eats, and the less she uses her legs and tail, the more money she will bring you. Keep a few acres close to the barn too rich for grain, and use it for a rotation of rye, sowed corn, beets, clover, managing to get two crops a year quite often, and presently you will be keeping fourteen cows and a span of fat horses, and refusing $200 an acre for your place.

TOMATO CATSUP.

Mr. H. W. Featherston, Union, Iowa.—Here is my mode of preparing tomatoes, and I think it beats all other catsup. For every two quarts of skinned tomatoes, one large onion, six bird-peppers, chopped fine, one teacupful of sugar, two teaspoonsful of salt. Boil about half an hour, and just before you take from the fire put one

quart of vinegar, one teaspoonful each of allspice, cloves, cinnamon, ginger and nutmeg, for every two quarts of tomatoes before boiling; scald well together, bottle tight and shake before using.

Canning Corn.

Mrs. Martha J. Pumpelly, Germantown, Mason county, Ky.—Having seen on many occasions, inquiry on this subject, submit the subjoined: My method is to cut from the cob and put it down in large stone jars, two-fourths corn and one of salt, by measure; mix well. We have no trouble at all in keeping it good all the year round in that way.

Mr. G. W. Goodrich, of Watertown, N. Y., writes: To such of the readers of the Club reports as put up sweet corn, and who don't, for winter use, I would say: There is as much difference between corn scraped from the cob and that cut from the cob, as there is between corn starch and an ordinary hasty pudding. I have tried several ways, and find it really delicious only when it is scraped from the cob immediately after it is husked. Then put it in dishes about the stove and ovens, and dry as soon as possible.

Wilson Strawberry.

Mr. C. R. Baker, Attica, N. Y.—I have an acre, from which I have sold over 2,000 quarts this summer. One-fourth of them were set two years ago last spring: picked over 600 quarts from them last year. The three-quarters of an acre were set one year ago last May. My ground is a *clay loam*. Some call it a "stiff clay" soil. I manured it with a good coat of barn yard manure, plowed it about eight inches deep, and harrowed it thoroughly; marked the rows three and a half feet apart; then set the plants from ten to twelve inches apart in the rows, kept the ground well cultivated, and hoed clean. Early in the winter I drew on coarse manure or straw, and spread it evenly over the plants for a protection against freezing and thawing. A part of my patch lay along the east side of a fence, over which the snow always drifts in the winter; so I was obliged to cover only those which were away from the influence of the fence; consequently those which were protected by the snow came into blossom a week earlier than the others, and of course we commenced picking from them just so much sooner. I found no trouble in selling them all at an average price of one shilling per quart in this market. Good judges pronounced them the largest average lot of Wilson's

they ever saw. I could have sold many more than I raised, as I received orders for them from other places on the line of the Erie railroad. If the season should prove favorable another year, as it has during the past, I shall expect a third more at least, for the runners are filling up the space between the rows so that I cannot run a cultivator between them without tearing up a great many plants, but the weeds must be kept out or there will be but little fruit. The Wilson is as good a berry as I wish to eat, but some prefer a sweeter one; those who do can find such in the list of popular berries. But he who produces a better strawberry, taking everything into consideration, can make a fortune out of it just as easy as he who produces a better sour apple than the Greening, or Red Astrachan.

I. N. Nutter, East Bridgewater, Mass., writes that Rev. T. O. Paine, of Joppa village, set out in the spring of 1868 eighty plants of the "Wilson" variety in hills twenty-two inches apart, first trenching the soil to the depth of two feet or more and applying a liberal quantity of stable manure. The runners were kept pinched off and the ground was mulched in August with a thin coating of newly-cut fine grass, and again at the approach of winter with a good cover of swale hay. He picked by actual measurement ninety-one quarts of nice strawberries, an average of one and one-eighth quarts per plant. The same number of plants in another bed, treated in the same manner, but not manured, yielded less than half the quantity mentioned. The writer of the above thinks the success noted may encourage those persons who, living in towns or city suburb, neglect to get a bed of this delicious fruit because their plats are small.

MEASURING MANURE.

Mr. F. B. Taylor, Bayley's Mills, Jefferson county, Florida.—We plant corn here at such distances as will give 2,340 hills per acre. I wish to compost cotton seed, &c., this fall to manure corn in the hill next spring, so as to give each hill two quarts of the compost, about 150 bushels per acre. The manure for each acre I wish composted in the middle thereof. Now what should be the dimensions of each pile? I haven't a library for reference.

A cubic foot of solid half rotted manure weighs about fifty-six pounds, requiring about thirty-six cubic feet to the ton. In measuring manure of bulk it is safe enough to call a cubic foot a bushel.

Adjourned.

September 21, 1869.

Prof. Samuel D. Tillman in the chair.

Potatoes.

Mrs. D. W. Caldwell, of Blairstown, Iowa, wrote to say that she did not see any good reason why she should not speak a good word for the Early Goodrich potatoes while others are lauding the Early Rose. "Two years ago," she continues, "my father sent us from Cleveland, Ohio, three small potatoes of this variety, from which we raised last season three pecks, which we planted last spring, putting two eyes in a hill. The 25th of June we had potatoes larger than a hen's egg. We sold two bushels for two dollars per bushel, only grappling the hills, which we continued to do up to the time of digging, eating all, a family of six with harvest hands, etc., desired, and, when dug the last of August, there were ten bushels left. Most of them were very large, and as mealy and pleasant flavored as any I ever tasted. My husband measured one, by no means the largest, which was ten inches by twelve. We think that is doing pretty well.

Mr. J. B. Lyman called attention to the contents of a box forwarded by Mr. M. C. Emery, of East Wallingford, Vt., and he read a letter from this gentleman, stating that the samples of potatoes sent were of the "Green Mountain" variety, originated from a ball of the "Carter" and considered by judges to excel all other sorts known in these United States of America. The potatoes were distributed to the members of the Club, who will commit them to their garden beds, and in due time report issue. A couple of communications confirmatory were also presented, one from J. Fletcher, pastor of the First Baptist Church in East Wallingford, and one from William Kent of the same town; the first saying he had "tried these Green Mountain potatoes, found them of excellent quality, and, as an early variety, likely to take the lead of any within my knowledge." The other saying, "It excels the Rose, and must become foremost as soon as its qualities are known."

Mr. L. W. Hamlin, Hollisterville, Pa., wrote briefly that a neighbor of his is anxious to learn whether or not a larger yield of potatoes than his of this season has been reported to the Club. From a planting made May 24, and dug August 28, he has returns as follows: One pound Early Rose produced 196 pounds; one pound Breese's prolific produced 116 pounds; one pound Climax produced 136 pounds.

Mr. A. S. Fuller.—I have received notice that one gentleman, whose name I do not recall, got sixty-seven and one-half pounds from a quarter pound of Early Rose. I do hope that the facts contained in the letters read to-day and at previous sessions will serve to teach farmers this lesson: that, as a general thing, six times as much seed is used as is necessary or desirable. Why, Mr. Chairman, sixteen or eighteen bushels used to be the allowance for an acre of potatoes. The reports that come in would seem to prove that better yields come from less than from more. I do not think that the Rose produces more than the old varieties would produce, provided the old varieties were as sparingly planted and as well cared for. A man pays a big price for, say, a pound of some new favorite; he cuts it into several pieces, and guards it well through the season. Let him pursue the same practice with the favorites of our forefathers and report his success.

Mr. H. W. Rymers, Elmore, Ohio.—From one pound of the Early Rose received by mail from Long Island I cut forty-two eyes planting one eye to a hill, three feet apart each way, covering with the plow, and during the summer the only implement used in their culvation was the common shovel plow. They were planted April 23 and dug August 20, yielding five bushels by measure, or 281 pounds. The soil is sandy, and has all the manure with it it can bear.

Messrs. R. & L. Stiles, East Troy, N. Y.—We think we are ahead of anything yet heard of with a potato crop. From three and a half ounces of the Early Rose we had a yield of sixty-four pounds. Beat it if you can.

Mr. J. B. Lyman.—Not long since I visited the farm of a model cultivator in Burlington county, New Jersey, that sends a great many potatoes to the Philadelphia market. He has found out by long experience the best way to grow potatoes, and he promptly rejects every method that is not the most profitable. He says the best seeding is two eyes to a piece, two pieces in a hill, giving four vines only. He gets more small potatoes by heavier seeding, but no more large potatoes. He commonly raises from 250 to 300 bushels of marketable potatoes per acre. This crop has taken him out of debt.

Mr. D. B. Bruen.—When planting time comes round I always rise early, take good sized potatoes, cut each in two or three pieces, and cover them in well manured hills. At least, that used to be my practice, but I have learned here that one eye would answer. I tried the

experiment this year with peach blows, and found it so. I observed, by the way, that the blossom end of the potato gave better returns than the other.

Mr. J. G. Gregory.—Forty years ago, when I was in my prime, it was the practice to use three bushels of wheat to the acre; afterward, it was found that two bushels answered better; and, later still, that a single peck sufficed, and brought a return of seventy bushels at that. I, myself, have raised a bushel and a half of potatoes from a single tuber. All this goes to confirm the statement that great quantities of seed are wasted. There is one thing more; we had better come up to a just appreciation of the importance of using less seed in all our crops, having that seed the best, putting it in in the best manner, keeping the fields clean, and gleaning after harvest, that nothing be lost.

Mr. A. S. Fuller.—I applaud this whole speech of our colleague, and, particularly, the closing words. I am firm in the faith that twenty-five per cent of our agricultural labor is wasted. Why is this thus? Why run over twenty acres for a harvest that might be grown on a quarter of that area, or a half at the most? Mr. Brown, or Mr. Jones, or Mr. Robinson, had better not attempt to make manure enough for ten acres answer for thirty, or four-inch plowing suffice where sixteen would be shallow enough.

Dr. Isaac P. Trimble.—Oh, the folly, Mr. Chairman, of speaking of farm labor wasted, and then counseling the use of a subsoil plow. Don't do it. I tried it over my ground, and my ground was worse in consequence for years and years thereafter.

Mr. J. G. Gregory.—If time served, I could tell of Mr. Lawrence, of Louisiana, a sugar planter, who was in the habit of plowing his alluvial land three inches deep. After a while he bethought him that he ought to get more than a single hogshead from an acre. So what did he do? Well, Mr. Chairman, he rushed into what Dr. Trimble would doubtless consider a stupendous folly. He sent over to England and got a steam plow, and turned up his plantation to the depth of eighteen inches. And now for the result—three hogsheads per acre, and enough extra profit in a single season to pay for the implement that did the business. What, Mr. Chairman, would have been his forlorn estate had he chanced to hear and heed the voice of the apostles of shallow plowing? Suppose he had taken the advice of David Pettit and Dr. Trimble; wouldn't it have been just as ruinous as though he had dumped two-thirds of his crop into the Mississippi river?

Dr. Isaac P. Trimble.—That may be very well so far as sugar goes just in that locality, but it has been demonstrated that in the cotton-fields three inches is enough and to spare.

Mr. J. B. Lyman.—It is true that fine crops of cotton are made by plowing three inches deep; for cotton, like the camel, is a child of the tropics, and can flourish on less water than any plant we cultivate. But the average corn crop of the largest cotton State is less than twenty bushels per acre, and in South Carolina it is six bushels an acre. A drouth that does not affect cotton will curl the corn leaves and turn them as yellow as a frost-bitten leaf. The planters never plow any deeper for corn than they do for cotton, and the result, in a dry time as this season, is ten acres skinned for a little pile of corn, when more would grow on one if tilled right. In Middle Jersey we have had a severe drouth, and the crop is cut down half and two-thirds. I asked a neighbor the other day about his corn. I saw it in May, and dug down to find out how deep he had stirred it, and I found eleven inches of good dark, mellow soil. "Well," said Mr. Rue, "my crop is good; the dry weather has hurt it a little, but I shall make sixty-five shelled bushels to the acre. Some of my neighbors, on land just as good, but shallow plowed, will not raise thirty."

Mr. A. S. Fuller.—There is not a farmer in my section of New Jersey that plowed six inches that has suffered at all this season from the drouth—at least in his corn field. If it were necessary, I would take the trouble to bring some stalks of corn from my place. Formerly the soil on which it grew was too poor for beans even. I plowed deep, manured liberally, and though there has scarcely been any rain since May, and I have not a leaf curled in my fields; not a leaf curled; and my neighbors are all burned up.

Mr. D. B. Bruen.—I live in a city, and believe in early rising, but I have space enough for experiment. I spaded ten inches, planted corn, kept it well hoed and hilled, and I have not a curled leaf in my garden.

The Concord Grapes.

Several plates of beautiful clusters of the Concord grape were placed upon the table by Mr. Alexander Palmer of the Modena fruit farm, located at Modena, Ulster county, New York. They were distributed among the audience and everybody seemed to think them good. Mr. J. B. Lyman remarked that he had visited Mr. Palmer's place; that Mr. Palmer had found great profit from the culture of

the Concord, and no great profit from other varieties, though he had made expensive and patient tests of all. In conclusion, Mr. Lyman hoped that Mr. Palmer, who might be properly considered "a Concord man," would give, at an early day, a full account of his practices of cultivation.

The American Pomological Society.

Dr. Isaac P. Trimble, who was a delegate from the Club to the convention of this society, held last week in Philadelphia, was called out to give an account of what he saw and heard. I had the pleasure (said the entomologist) of meeting distinguished gentlemen from nearly every State in the Union, and some from Canada. There was a large collection of fruit, that from California being very large. In all, I believe, there were 1,300 plates. I noticed 240 varieties of pears in one collection, but many of them were poor, some very poor. This must necessarily be so. The show of fruit from Cumberland Valley, Pennsylvania, was the best on exhibition, with the single exception of that sent from Kansas, and the trees that produce it were set in holes dug with a pick ax in shale. The reason for excepting Kansas, and the explanation of the beautiful display made by that State, was because of the State governments having made appropriations to encourage the growth of fine fruit. The consequence was, Kansas took the highest award, the gold medal; and this fact, as remarked to me by a resident, will have great influence in encouraging further advances. The fruit was not so large as some we have seen from California, but larger than from New England. Taken all in all, the exhibition was, save in this single item of peaches, better than last year in St. Louis. The business of the association was to settle the merits of fruits, arrange catalogues, &c. The gentlemen connected with the American Pomological Society are doing much service in the fruit field. Charles Downing, for example, is devoting his whole life to the interest, and others might be named.

The Chairman.—In connection with Dr. Trimble's statement with regard to Kansas fruits, I may say that some splendid specimens from the same State have just been placed on exhibition at the Institute fair.

Jersey Marl.

Mr. D. B. Bruen made a casual allusion to the fact of his having tried marl on corn and potatoes during the past season with excellent

effect. Of potatoes, he got better quality and fifty to seventy-five per cent more in quantity. On corn marl proved as serviceable as wood ashes. Mr. Bruen also referred to a neighbor who had similar experience.

Dr. Isaac P. Trimble.—This is the first report from that ninety tons that were distributed through the Club some months ago. This goes to prove, and I doubt not there will be other reports to the same effect, that Mr. Quinn was wrong in speaking of marl in the way he did, when he said it did no good on his red lands in New Jersey.

Mr. A. S. Fuller.—I was not aware that any one doubted the value of marl. The question has been, and is: Will it pay to transport it far? Solon Robinson said in this room once, that it would not pay to draw barn yard manure two miles. It pays me to barrel it in New York, and send it thirty miles by express. Barn yard manure I find most profitable, excepting bone dust only.

Mr. J. B. Lyman.—There is such a thing as land getting marl-sick, as the farmers call it. For instance, a man in Salem county told me he raised his land from a producing capacity of twenty-five shelled bushels of corn per acre to a producing capacity of sixty-five per acre. and marl would carry it no further. Others say that after a time the addition of more marl ceases to benefit. The surface will not respond, but it is only after the land has been raised to high fertility. As to Mr. Quinn's statement, I have no doubt of its truth but we must remember that no forty acres in New Jersey has received so much manure as his farm. No wonder that a manure, consisting mainly of potash, will not show upon a surface of disintegrated red sandstone, which contains some potash, a surface which has been charged with ashes, bone dust, cinders, blood, fish, guano, and stable manures. It is enough for us to know that lands that are poor can be made rich by the use of New Jersey green sand. The real question is, whether, considering the weight of the fertilizer, it will pay to use it beyond a certain distance from the pits.

Dr. Isaac P. Trimble.—The last speaker is probably mistaken about land getting marl-sick. So far as my observation has gone, it has been the same in south Jersey, with marl, as in Pennsylvania with lime. In the latter State there is never a time when it does not pay well to apply lime, and the same is true with marl in New Jersey. However, this is to be said, that in order to bring land to the highest condition, it is necessary to put on more and more each time.

Prof. Jas. A. Whitney.—As disagreement is in order, I shall be obliged to take issue with Dr. Trimble. On this our friend Lyman is clearly in the right. The elements of every plant, ammonia, potash, phosphoric acid, etc., within certain limits always exists in definite proportions. If there is only sufficient ammonia in the soil for sixty bushels of corn, and potash and ammonia enough for a hundred bushels, sixty bushels is all we can get, and it will do no good to add more potash and phosphoric acid, as for instance in the form of marl. Barn yard or other ammoniated manure is needed to supply a proportionate quantity of the needed constituent. A stinted supply of any one constituent of a crop or plant will limit its growth as much as if all were equally limited.

Cranberries.

M. Chas. H. Cummings, Windham, Conn., wished to inquire what kind of land is required to flow for cranberries, and will it pay to lay out $100 on a dam to flow one-half acre of the right kind?

The Chairman.—Of course it would pay, and pay well.

Mr. J. B. Lyman.—A great many persons having low, wet lands think they have a true cranberry soil, and ask for advice in planting. In answer, I will say briefly that the cranberry thrives and derives its sourness from acids in cold, sour, peaty soils that are useful for no other agriculture. But a situation that is low and peaty, my be for other reasons unsuitable for this peculiar crop, that wants what nothing else does, and lagnuishes in a fat soil. You dig ditches, get rid of grass and bushes, and set in cranberry plants. They will grow, and so will the grass and weeds. The grass may grow faster than the cranberries, and you cannot cultivate in the usual way, for the runners of the plant must not be disturbed. A very peculiar treatment is found practicable; apply sand. If you have that which is fine and white, so much the better. Building sand, glass sand, is the best for cranberries; you want to get rid of all color and all fertility in the top-dressing; put it on four inches deep; it will kill everything else, but the cranberries like it and are happy. In three or four years they will want another dose of sand. But this is not all; this singular vine loves to be drowned as well as starved, and requires for perfect health and vigor to sleep during the winter at the bottom of a pond. I would say, then, to this correspondent, and all others like Mr. Cummings, that raising cranberries on a large scale and with high profit, depends on four conditions: 1. Have you a deep black peat, sour and cold? 2. Have you a sand bank handy? This sand

should be as sterile as the shore of the unplanted sea. 3. Can you build a dam so as to flood it in winter and keep the side ditches half full all summer? 4. Can you expend from $200 to $400 per acre and lie out of your money three years? If Mr. Cummings can answer these questions in the affirmative, let him go in. He can have a cranberry garden in that swamp worth $1,000 an acre.

THE SUNFLOWER.

A correspondent sends the following account of the sunflower. This plant produces the finest honey and wax, large quantities of which are exported from Russia and Turkey. When the seed is crushed as linseed is, it will produce the finest oils, in larger quantities in proportion to any other seed, for the table as well as the painter, particularly in mixing green and blue paints. The cake is superior to linseed for fattening cattle; the oil makes the finest soap, very softening to the hands and face, and superior to any other for shaving. Sheep, pigs, pigeons, rabbits, poultry of all sorts, &c., will fatten rapidly upon it and this seed to any other, pheasants in particular, causing them to have much glossy plumage and plumper in body; this seed when shelled, makes on being ground, the finest flour for bread, particularly tea cakes. It will grow in any corner that may be vacant, and make all farms have a most agreeable garden-like appearance. It should be planted about six inches apart, and about one inch deep, and when about one foot high it should be earthed up; it will then require no further attention; every single seed will produce 1,000 or more; the main head generally produces from 800 to 1,000 seeds, and there are generally four collaterals, producing fifty or sixty seeds each; another great advantage this seed has over any other is that when ripe it turns its head downward, so that no rain can effect the seed; but it is not only the seed that is so valuable, the stalk is most so, for by treating it exactly as flax is, it will produce a fiber as fine as silk, and that in large quantities. And now that rags have become so valuable, arising from the unprecedented demand for paper, the stalk might be make useful for that purpose. On some grounds two crops may be growing at the same time, for when the farmer has given his early potatoes their last hoeing, he may plant this seed twelve inches apart in the ridges.

REPORT ON HORSFORD'S BAKING POWDER.

It will be remembered that a number of communications were received by the Club some weeks ago, stating that injurious results

had been experienced from the use of Prof. Horsford's well-known baking powders. Of these letters some were so abusive and personal as to be unworthy of notice, while others were evidently written by persons sincere in their strictures, but with little knowledge of chemical principles, and others still by those who having felt an uncomfortable degree of internal disturbance, very naturally desired to ascertain the cause. To the two classes last named, the report of your committee is directed. The Horsford method of bread-making depends upon the combination in the bread of phosphoric acid and bicarbonate of soda. The phosphoric acid expels from the bicarbonate the carbonic acid which acts to lighten the bread, while the phosphoric acid unites with the soda itself to form a phosphate of soda claimed to correspond to, and to be assimilable in the same manner as the phosphate of potash found in plants. The objections urged by some of the correspondents above referred to, were, that as phosphoric acid is derived from phosphorus, a deadly poison, the acid itself must possess like injurious properties. This is not tenable. When phosphorus combines with oxygen to form phosphoric acid, its properties are changed just as the properties of chlorine and sodium, both poisonous, are changed when they are combined in common salt. It is possible that either free phosphoric acid or uncombined carbonate of soda, would, in the stomach, produce the same sensation of burning spoken of in some of the letters, but this would occur only if the admixture of the two components of the baking powder were imperfectly mingled or combined. This will be likely to occur to some extent in making bread and seasoning *a priori*, the addition of oily matter or shortening would be desirable, inasmuch as the alkali and free acid would be likely to be neutralized respectively by the acid and other constituents of fat or oil. Your committee have made their report thus brief for the reason that with the slight qualification just indicated, they see no reason to dispute the claims put forward by Prof. Horsford in behalf of his preparation. As to the utility of the latter in actual use, your committee believe that its merits are justly and fully set forth in the subjoined testimony of a practical housekeeper, Mrs. Laura E. Lyman, who having used the Horsford yeast powder for nearly two years, has kindly forwarded to your committee the following statement: When the first box of Prof. Horsford's preparation came into my house I used it for bread-making and followed the directions strictly. The bread produced was whiter than common, and perfectly raised, but it wanted the peculiar flavor of yeast-raised

bread, and some of my family complained of a peculiar uneasiness at the pit of the stomach for some hours, but others who ate it had no such sensations, and no ill consequences followed. I then tried it in biscuit, in pound and plum cake, and in breakfast cakes, using milk in making the dough. It works to perfection, and I am charmed with it. Especially in corn bread of all sorts, I prefer it to any other mode of securing a light sponge. The richer the article I make the better Horsford powders work upon it. Something in the oil seems wholly to neutralize the sharp taste which was noticed in bread. It substitutes certainty for guess-work in my pantry, and is as much superior to the former way by soda and cream tartar as the best kerosene is better than the old tallow dip candle.

J. A. WHITNEY,
J. B. LYMAN,
Committee.

The Chairman.—This estimate agrees with that of Prof. Liebig and other eminent chemists who have given the subject attention.

Herds-Grass and Timothy.

Mrs. M. A. Leakin, Harmony, Wisconsin, would know the difference between these two varieties of grass.

Mr. J. B. Lyman.—Without going into nice botanical language, the head of timothy is round like the head of grain or a cat-tail from the swamp, about four inches long. It flowers in this climate about the 1st of July, and then it should be cut. It grows well on uplands, and the crop responds exactly to the quantity of good yard manure spread upon the ground. It is the strongest and heartiest grass we have, but not the juiciest. It should be fed to horses and working oxen. Herds-grass has a bushy top like the tail of a fox, and is similar in color. The stalk is slender, shiny and wiry. Its favorite place is a black, peaty meadow, and it will stand more mud and keep up a stiffer fight with weeds and rank grass than any other. But it has not the sweetness or strength of timothy, and should be fed alternately, or mixed with richer grasses. Old farmers think twenty pounds of timothy will do a creature as much good as twenty-five or thirty of herds.

Mr. N. C. Meeker.—I am aware that Webster gives the general name herds-grass to timothy, red-top and fox-tail; but the distinction as given by Mr. Lyman is correct. He did not say that herds-grass

and fox-tail are the same, but that herds has a reddish bushy top, while the head of timothy is round, small and firm. The seed of herds-grass is mostly produced on the salt meadows of the Delaware; it grows on a black peaty soil, quite too wet for timothy, and flourishes so well that three tons per acre is not a wonderful crop. There is, however, great irregularity of usage in speaking of the grasses, and some fixed names ought to be agreed upon; and is doesn't help matters at all to call timothy *phleum pratense*, fox-tail *alopecurus pratense*, and red-top *agrostis vulgaris.*

Mr. S. Edwards Todd.—In many parts of New England, timothy grass (*phleum pratensé*) is known and spoken of as herds-grass, and in many counties of New York farmers know nothing about a kind of grass by the name of timothy. But they are familiar with herds-grass, which is nothing more nor less than the genuine *phleum pratense.* In some other states we find that the grass known and talked of as herds-grass is the "English grass," or bent grass, or fine bent grass, or Burden's grass, fine-top or red-top (*agrostic vulgaris*). To corroborate my assertion touching the great variety of names applied to what is known as herds-grass, I will read what C. L. Flint, in his "Grasses and Forage Plants," states with reference to herds-grass. On page thirty-four, herds-grass is one of the names given to timothy (*phleum pratense*). He also states, that the name timothy was obtained from Timothy Hanson, who is said to have cultivated this variety extensively, and to have taken the seed from New York to Carolina. He says, also, that this *phleum pratense* is frequently called herds-grass in some parts of New England, Pennsylvania and States further South. He says the name "herds-grass" is applied to the red-top of New England. Then, on page forty, when describing red-top (*agrotis vulgaris*) he gives it, among other names, the name of herds-grass of Pennsylvania and the Southern States. These two grasses under consideration are very unlike, and a superficial observer can easily distinguish a marked difference between them. The timothy (*phleum pratense*) has only a single head on the seed stem, which is of a cylindrical form, like the tail of a cat. Hence the name given to this grass in Europe, as the cat's tail grass. On thin soil, timothy is somewhat inclined to grow in small tussocks or tufts, which the red-top never does. Timothy will spread very little from the roots, while the red-top (*agrostis vulgaris*) is provided with creeping roots, like the Kentucky blue-grass (*poa pratensis*), which will spread rapidly through the soil, sending up stems from every

inch or so of the creeping roots. Most of the grasses of this genus, of which botanists assure us there are many species, are known as "bent grass."

To Pickle Cucumbers.

A lady correspondent at Pawlet, Vt., writes: I find an inquiry how to make pickles of small cucumbers. I would like to send you a recipe which I have used for several years with success, and have heard the pickles called superior, repeatedly. Pick over the vines every other day, select the perfect fruit, wash clean, and cover with a strong brine for twenty-four hours. Then take them from the brine, rinse with clear water, and drain them dry. When dry, pack them close in stone jars, and cover with good vinegar. Red peppers may be added if we like. Good, old vinegar, will keep pickles prepared in this way for a year without its being changed. Watered, flashy vinegar, will scum over and need to be changed.

A Model Bee House.

Mr. John B. Bader, of Mont Clair, N. J., showed a plan for a bee house, with screen, that was much examined and commended.

Ramie.

Mr. J. W. Gregory, showed two styles of fabric, one fine and glossy, woven from the real ramie; and the other, less brilliant, from the Bohemia nevia or China grass. He thinks the experience of the past year will confine the ramie enterprise to the belt south of Savannah, as it is easily chilled and checked in its growth.

Earth Closets.

The company who have this commendable enterprise in hand, write a letter asking the Club to consider the value of their invention to agriculture. They propose to take steps to supersede the present wasteful method of managing those matters, and to contract with some of the manure-buying farmers near New York, to supply them with a compost superior in fertilizing power to anything now sold.

Adjourned.

September 28, 1869.

Nathan C. Ely, Esq., in the chair.

Sweet Potatoes.

S. J. Brownson, Osborn, Mo.—Having been a constant reader of your reports, I respectfully request information, through your paper, concerning the culture of sweet potatoes.

Mr. J. B. Lyman.—It is a mooted question how far north the sweet potato can be grown with profit. Above forty degrees, or a line drawn through Philadelphia and Columbus, Ohio, not many are raised. South of that line it shares the affections of farmers equally with the round potato. In the Carolinas the season is long enough to make a crop without artificial heat in sprouting; but in Missouri some arrangement for producing heat is desirable. The following is recommended to Mr. Brownson:

Sink a pit two or three feet deep, fifty long, and eight wide. At one end build an arch of brick about as long and big as can be set over the halves of a big hogshead split up and down, and set end to end, open side down. At the end of this arch make a small flue by putting two brick on end and laying another across. Have a short chimney at the back end of the pit. Drive stakes at the sides; level their tops and lay a rude platform over the flue about a foot above the brick. Make sides to it a foot high and bank it in all around. Kindle a fire and this hole or pit will come up to eighty degrees or thereabout, and stay there a long time. Sprinkle the platform over the flue with earth and on this earth lay your sweet potatoes half an inch apart. Cover them two or two and one-half inches deep, and sprinkle often enough to keep the bed duly moist. In a few days you will have thousands of plants for yourself, and you can sell enough to pay for all the pains you have taken. If the first set are broken off, others will sprout at once. You will need a fire, off and on, about three weeks. There is no use in preaching the doctrine that big potatoes will grow on a dry, sandy soil without manure. It is not so. A warm soil is best, but if you want size and profit, you must have fertility. Hill up well. A sweet potato wants heat; it naturally loves the sun. Work well, but not often. If weeds come after the vines are spreading, pull them up by hand.

Making Ice.

W. Taliferro, M. D., of Gloucester Court House, Virginia, would like information as to the best, simplest and cheapest mode of produc-

ing ice artificially, and as near as possible adapted to the wants of individuals and families.

Prof. Jas. A. Whitney.—As yet, the art of producing cold for ice manufacture is not so popularized as to be adapted to the wants of an isolated Virginia planter. But it soon will be. Ammonia is the older chemical employed; of late a subtile product of coal oil, called chimogene, is found cheaper and equally effective. By pressure it is made liquid, and then, when passing into gas, intense cold is produced, because the gas takes up vastly more heat than the liquid. A machine might be made for fifty dollars, which, by a double-lever pump worked fifteen minutes, would condense enough of this substance to cool a dining-room from ninety to seventy degrees, and make abundance of ice for dinner." To which we may add that an apparatus of the sort alluded to will be on exhibition at the Institute fair this fall, and we may take occasion, at the proper time, to give some description thereof.

Remedy for Pear Blight.

Mr. Chas. Frank, Chautauqua county, N. Y.—I have an orchard of standard pears that are generally affected with the blight, tops dying; the substance that runs from the diseased limbs is like tar. What ails them, and what shall I do?

Mr. P. T. Quinn.—Cut off the dead or injured parts of the trees at once, six or eight inches below where the disease shows itself on the branches. Destroy the portion removed by burning. When cutting off large branches at this reason of the year, cover the wound with a paste made by dissolving gum shellac with alcohol or with a coating of ordinary grafting wax. In case the injured trees are disfigured they may be made symmetrical by putting in grafts in the spring, when the branches are large enough. I have saved valuable pear trees, that were badly injured by fire blight, by following this course.

A Cure for Bloat or Hoven.

Mr. Paul Miller, Columbus, Wis.—I wish to contribute an easy remedy for a disease or accident which has been very common this summer. I used to be a Cheshire, England, dairyman twenty years ago, and had a stock of nearly 100 cattle. Growing many acres of turnips, choking of the cows was very frequent, and the simple remedy was a stick about a foot long and an inch and a half square put in the mouth as a bridle bit; a string from each end to each horn

tied to keep in place. Placing the stick instantly releases the imprisoned foul air from the distended stomach and prevents more swelling. Whatever root sticks in the throat will in time soften and go down, and no bad effect can follow unless force is used. Until this summer I had never seen a case of bloating from eating grass or clover. In June my next neighbor had a case and asked my assistance. I placed the stick, and she was relieved in a few minutes. The same day my cows (through a board being down in my neighbor's fence) got into clover, and, before I knew, one died. Numbers were loooking on while she was struggling and dying, but knew no remedy. To-day another neighbor had a similar case and effected a cure by the means described.

The Chairman.—The tone of this letter indicates such kindness of feeling toward the lower animals as I am always pleased to receive and welcome. I doubt not the treatment prescribed for the complaint alluded to is worthy of confidence and trial.

Wood Ashes.

Mr. Martin Allen, Mendota, Laselle county, Ill.—Can some member of this Club inform me if it will pay to haul leached ashes from a soap factory, four miles, to manure horticultural products on a soil that is rich in vegetable mold, such as our ordinary prairie soil, and if so, to what particular crops had the ashes better be applied.

Prof. James A. Whitney.—Leached ashes is a term that may mean so many things, or so many degrees of the same thing, that advice must always be received with allowance. The leaching may be thorough, or may take out a fraction only of the valuable elements. Then again the wood makes a great difference. Pine ash is not worth hauling half a mile. The ash of elm is the richest. A prairie soil may be benefited by ashes just as much as a sandy or a granite soil. I recommend the application of ashes in three ways. 1. As a top dressing on grass land spread broadcast after mowing, or in the spring. 2. In the hill with potatoes, mixing the ashes with lime and a little salt. 3. On corn and grain mixed dry, with hen droppings and plaster. I think a two-horse load of hard wood leached ashes is worth from three to five dollars to a farmer.

Broom Corn.

Mr. Martin Allen, Mendota, Ill.—I will venture to ask you a question or two in regard to raising of broom corn. What amount

can be raised per acre on prairie land in Illinois? Is it a profitable crop either there or here in the east? What preparation of the soil and what is the best manner of cultivation?

Mr. A. B. Crandell.—Some weeks ago when traveling up the Connecticut valley, I paid special attention to this crop. They raise it largely about Northampton, Hadley, Hatfield and other of those river towns. I could not learn that it differs much from Indian corn in the preparation of the soil or cultivation. The chief advantage they derive from broom corn, is the regular work it gives in winter. There it is raised with tobacco and demands excellent land. Those two crops will so occupy the hands in cold weather that the farmer can afford to hire by the year. In this way he gets better labor and more of it at moderate rates. As a general calculation, four hills will furnish enough to make a broom that will sell for twenty cents. Thus five cents may be made from each hill by adding the cost of broomstick, twine and labor. The seed will pay for planting, tending and harvesting.

SMUT IN WHEAT.

Mr. Arch. Rhenez, Warren, Pa.—I have been in the habit of raising wheat on my own account, in this and the old country, for upwards of sixty years, and for at least fifty of these years never had any smut. I give you my preventive for the public good. My opinion is that the cause is a fungus, that must be killed, and blue vitriol or sulphate of copper is the cure. Have some vessel that will hold your seed, and take four ounces of vitriol to each bushel of wheat; dissolve in hot water, then fill into your vessel as much cold water as you think will float your quantity of seed, add your dissolved vitriol, then put your wheat in gradually, and skim off any refuse; when done, allow the whole to stand for two hours, and then drain off the water by a faucet at the bottom. Do this in the evening, and your seed is perfectly dry and ready to sow in the morning, by hand or machine. No lime or anything else is necessary, and if properly done I will insure the crop for a small premium.

W. H. Town, Onondaga, Michigan.—I will give a little of my experience in wheat growing from smutty seed, or seed infected by smut. About twenty-five years ago we were damaged a good deal by smut in our wheat, and the difficulty of obtaining seed free from smut was very great. Years after we continued to be troubled more or less in our vicinity, until an Englishman settled there and gave us a remedy, which was to take about the bulk of a pint of unslaked

quicklime to the bushel, put it into boiling water of sufficient quantity to saturate the wheat, put it in a pile on the barn floor, put on the liquid boiling hot as soon as the lime is slaked, and shovel over until well mixed. This process seemed to produce the desired effect; and as often as smut has appeared in my wheat, I have repeated the same process with the same result.

Mr. D. W. Cogswell, Henniker, N. H.—The following receipt has given perfect satisfaction in my vicinity for years: Two ounces blue vitriol and two quarts of salt, well dissolved, to a bushel of wheat; wash the wheat in the above solution. I sowed three bushels of wheat this year which was raised two years ago, and proved to be very smutty when gathered. Last spring I washed the wheat in the above solution, when sown, and have not been able to discover the least appearance of smut this season. My wheat never was better than now. Have counted eighty-two good plump kernels in a single head.

The Far West.

Mr. George May Powell, of New York city, wrote from Council Bluff, Mo., that the causes which underlie the fertility of this region seem of such national importance as to be worthy of special investigation. In this region 100 to 125 bushels of corn to the acre, and forty bushels of wheat, are reported to be raised with no more labor than is required to produce half these yields in the Mississippi valley. The two chief reasons for this fertility appear to be, first and mainly, the impregnation of the soil of the region with alkali brought by the streams from the sterile sage plains of the farther West; second, the soil is a clayey, calcareous alluvion, which has been changed by washing and mixing with silex, an organic matter, from the usual tough, laminated structure of clay, to such a condition that a lump of it may be crushed in the hands to powder like a lump of ashes compacted by wetting and drying. Hence the crops may feed on it as greedily as they will. This soil is also said to yield beets, in which sugar predominates instead of woody fiber, as in those raised in black alluvion. The growth of hemp produced in this soil is very large. These and some other crops were heavier than are often seen on such soils which look darker and richer. In conclusion, Mr. Powell expressed the opinion that a thorough examination of the composition of the soil in this Missouri basin, and of the comparative yield of various crops raised there and in other sections of the West and South, is well worthy of attention.

Prof. Tillman agreed, and offered a resolution, which was carried, that Mr. Powell be invited to furnish the Club with any new facts he may have obtained in relation to the influence of the alkaline deposits from the upper plains on the soil of the lower basin of the Missouri, and such other information regarding the productiveness of that region as, compared with others, may be of general interest to agriculturists.

Adjourned.

October 5, 1869.

NATHAN C. ELY, Esq., in the chair.

HOW TO SHIP APPLES.

Mr. E. Hill, Clio, Michigan, would like to know whether apples keep best when transported in tight or ventilated barrels.

Mr. P. T. Quinn.—It depends entirely on the distance. I live twelve miles from New York, and send pears in flour barrels. It generally takes about three hours to effect the transportation, and I have frequently observed that, even when shut up no longer than this, the paper with which I line the barrels becomes quite damp. It is easy to understand that this dampness would soon generate mould. In sending to Cuba, as I do to a great extent, I bore holes in heads and sides of barrels.

Dr. Isaac P. Trimble.—In the west it is the practice to leave apples to season, or sweat, before putting them in confined quarters. Even then, however, the boring process is found advantageous.

CONCORD GRAPE.

Mr. Alexander Palmer, Modena, Ulster county, N. Y.—Fruit-growing in this country is assuming a position worthy to be classed among the most profitable and important branches of husbandry. We, as a people, are changing our meat-eating propensity for that more healthful and refining diet of vegetables and fruit, denoting a higher civilization and a movement onward in the right direction. The strawberry, peach, apple and the grape, are the four standard fruits of our market, each supplying in their season a demand that is annually increasing. It is becoming evident that we can never grow these fruits in such abundance as to glut our market. Their excellence and healthfulness will alone cause them to be "gobbled" up by the masses and generally at fair prices for the producer. The Concord grape is becoming the standard in its class, like the Green-

ing apple, Wilson strawberry and Bartlett pear, which have proved by their hardiness and productiveness to be worthy of general cultivation. The sudden and extreme changeableness of our climate, the ravages of insect and disease, renders this country, with a few local exceptions, rather unfavorable for growing successfully the finer varieties of the grape; but the Concord, which originated among the cold bleak hills of New Hampshire, has such a strong, healthy foliage, and is naturally so vigorous and productive, enabling it to withstand all these unfavorable conditions, and produce regular crops of fruit, although not of such high quality as to suit the fastidious taste of the "amateur," yet, by the multitude, it is highly prized and freely purchased at prices nearly equal to the "Delaware," or those other varieties of a higher standard, and for this reason it has been so highly and justly honored with the greedy prize for being the best grape, all things considered, for general cultivation. I will speak very briefly of the exposure, the soil and its preparation, the general management, and the pecuniary advantages of grape culture. It has been the practice in every country and in all ages of the world, and is *now* generally admitted, that a southeastern exposure is the most favorable condition for the full development of the grape. For the moist and uniform temperature of Europe, as well as the southwestern portion of our continent, this exposure might possibly be the best one to adopt, but in the northern and middle States, according to my observation and experience an exposure, rather inclining to the northwest supplies that uniform temperature that is so essential to a healthy growth of the vine. A vine planted in a warm, sheltered location, will put out too early in the spring, and will also be more exposed to the extreme heat of summer; but the most unfavorable feature of such a warm situation is that it will not mature and ripen its wood, but still continue to grow like a "green," heedless thing, only to have its "beauty" marred and "fond hopes" blasted by an early frost. But if it is located in a position where its cheek will be fanned by the first cold blast from the north, this will give nature warning to clothe herself with sufficient protection to guard against that danger. If the buds are not matured and the wood well ripened in the fall, we are quite sure of missing a crop the following year. It is a well established fact both with plants and animals, that in a higher latitude nature clothes them with a thicker protection than she does in a warmer climate, hence the advantage of a northern exposure has some claims and is worthy of further

investigation. If the Concord received its vigorous and hardy character from the cold regions of its birthplace, may we not have much confidence in the success of the celebrated "Walter grape," which originated in a bleak valley of Modena, Ulster county, New York, celebrated for its early frosts? For hardiness it doubtless has many advantages over the Iona, Roger's Hybrid, the Eumelan, and other varieties that originated under more favorable circumstances. In regard to the most suitable soil for the grape is a question that can only be settled by experiment; each variety requires a soil that can supply those elements necessary for its healthy development. The "Hartford Prolific" and Catawba are the best suited and give their best results on a soil inclined to a clay loam; but the Concord is one of those strong, rampant growers, and will generally take care of itself and succeed on any soil that will grow corn well. You will please indulge a few plain thoughts that might be of some value to new beginners, in regard to preparing the soil, &c., which should be well done as it is done once only in a lifetime. To thoroughly mix and pulverize the soil, from twelve to fifteen inches in depth, would not suit either the advocates for shallow plowing or deep tillage; yet, such a preparation would doubtless produce the best results on a vineyard, and it can be done very cheaply by using a large mold-board plow, commencing in the ordinary way and going two or three times in each furrow, lengthening the chain at each time going through. This will mix and pulverize the soil in a most thorough manner, and if there is a good coat of coarse manure spread on the surface before plowing, a portion of it will fall in the bottom of the furrow and gradually decompose, leaving the soil loose and porous for a great length of time. After this preparation of the soil, planting is then a very simple process. Use a small plow to mark out the rows, running them north and south, say ten feet apart, for the strong growers like the Concord, and after opening these furrows with a large plow some eighteen or twenty inches deep, stretch a line crosswise at right angles, and set a stake in the furrow at each angle, planting a vine at each stake, spreading the roots in the furrow, and covering them with the finest soil, pressing it slightly around the roots, and it is all done in less time than the same amount of land could be planted with potatoes. Clean culture is the only true method in managing a vineyard, as elsewhere, and the best way to destroy weeds is to never let them grow, and perhaps the best implement for doing this is the Excelsior Wheel Cultivator. The method of pruning the vine for the

first and second year depends somewhat on the system of training to be adopted in future, one strong cane the first year cut back in the fall to two or three feet, the two upper buds of this cane to be used the second year to grow the main arms, which, for the Fuller system, require to be left about five feet long, and for the long arm, or "fan system," the canes must be left about seven feet long. The trellis to be put up the third year for the latter system requires only two wires —one to be placed three and one-half feet from the ground, and the other six and a-half feet from the ground. This system of training is a very simple one and is considered by many good grape-growers to produce the best results, but the horizontal arm, or "Fuller system," is decidedly the most neat and systematic mode of training the grape; and I would very much prefer this system, but for one objection, and that is pruning back the renewals to two or three buds. By this method we often cut off the chances for a crop the following year, for it is very well known that the lower buds on a strong cane are seldom fully developed, and that the best fruit buds are found at a distance further from the main arm. To insure regular crops we should aim to grow strong canes, with well developed fruit buds, and no matter what system we adopt in pruning, these buds should be preserved; and in doing this there is danger of leaving too much bearing wood, which can be regulated at the first disbudding the following spring, which should be done as early as the buds have grown about two inches long, by rubbing off all, and especially the naked ones that are not required for the crop. If this early disbudding is properly done, then all the summer pruning required for the Concord is a slight thinning and regulating about the latter part of July. The Concord requires about eight buds to be left on each arm, making sixteen buds; and three clusters each, making forty-eight clusters, averaging about twelve pounds to the vine, at 400 vines to the acre, making a total yield of 4,800 pounds of fruit; this at fifteen cents per pound amounts to $720. This estimate, I think, is rather higher than the general average of vineyards; yet considering the fact that wheat, corn and grass—our staple crops—often fail from natural causes, I am well satisfied that a Concord grape vineyard, favorably located and well managed, is the most certain and profitable crop we can grow. I leave to those benevolent amateurs, who are willing to sacrifice for their country's good, the honor of experimenting with those new varieties, in order to find a hardy grape of a higher order. Their object is worthy of their highest

ambition. For he who succeeds in getting a grape that is as hardy and productive as the Concord, possessing the best qualities of the Iona, Delaware and Diana, will become a public benefactor, and will carve his name high. But we who mean business, and grow grapes for our "daily bread," may continue to plant the Concord with full assurance that we will be liberally rewarded with "good crops" and fair prices."

Mr. A. S. Fuller.—This is a good paper, and I hope it will have a place in our annual volume of Transactions. There are a great many who would like some better grape, but as I remarked to my wife this morning at the breakfast table, I don't know at present what we should do without the Concord. As regards the place of planting, I may say that my vines stand on the north-eastern exposure. I apprehend that the idea of the advantage of protection is considerably overrated.

THE GRUB WORM.

Mr. E. S. Stone, Wabash, Indiana.—There is a kind of grub, that is, a large white worm with a brown head, that has destroyed some fields of corn this year and done some injury to meadows, but more especially to the blue grass sod. I can take hold of the grass along the railroad and strip it off just as easily as one can remove a carpet from the floor. What will become of them? Will they do any harm next season?

Dr. Isaac P. Trimble.—This pest, for the first two years of its life, lies low; the third year it comes up to the surface, and after that changes into a beetle. There will be no trouble from him next season, but possibly a new generation may appear and go on with his evil work. These grubs are such as crows search for, also chickens and hogs, and in this connection I may relate that English farmers once seeing the grass fields dying, laid it to the crows and began a warfare against them. The event proved the error of their judgment.

THE MINK.

Mr. A. Hayford, Canton, Maine, wrote to solicit information in relation to breeding mink, and William Scofield, of Stamford, Ct., is interested in the same subject.

Mr. A. B. Crandell.—I was recently in correspondence with Mr. L. Stratton, of Grassy Cove, near Crossville, Tennessee, a gentleman who has been to considerable expense of time and money in studying

the habits and experimenting upon the practicability of rearing in confinement these and other fur-bearing animals. In reply to some interrogations of mine, he kindly stated that minks are by nature solitary, wandering creatures, being seldom seen in company except during the breeding season. It is, therefore, impossible for them to be reared successfully if large numbers are kept constantly together. The females, at certain times, will quarrel and fight, and even kill their own and each other's offspring. At least Mr. Stratton has found it so, invariably. He thinks, however, that possibly, after a few generations, they might become partially domesticated—their wild nature, in a measure be "bred out." Still, at the beginning, they may, with proper treatment and careful handling be made to spare their young, even if several are kept together, provided the inclosure be a large one, and have suitable accommodations for feed, water, &c. The male and female should be permitted to be together frequently from the middle of February until the middle of March. At all other times, keep them entirely separate. The young minks make their appearance about the first of May. When wild in the woods, they will seldom vary five days from this time; but when kept in confinement there is greater variation. About this season they should have plenty of fine hay, which they will carry into their boxes to make nests. A box three or four feet long and eighteen inches wide, is the shape they prefer; it should be placed as far as possible from the water, to prevent the mink from carrying water and mud into it. The young minks when first born are small and delicate, destitute of any kind of fur, and much resembling young rats. If the old mink is tame, the young ones may be taken out of the nest and handled when they are three weeks old. They will soon learn to drink milk, and may be fed every day. At five weeks old they may be taken from the mother and put into a pen by themselves, when they will soon become very playful and pretty, and make much better mothers than they would if allowed to run with the old ones. Mr. Stratton has a plan for the construction of a mink-pen, which he has never tried, but which he says he should try were he to engage in the mink business again. The shelter should be in the shape of a long box, five or six feet wide, and three or four feet high, set upon legs, and with a good floor and roof. Divide it into separate apartments, six feet long (or longer would be better), the front of each apartment to be furnished with a swinging door of strong wire screen, with the hinges at the

top, and a button or some kind of fastener at the bottom. A trough six inches square, made by nailing three boards together, should run the whole length of the pen on the back side; one end of the trough should be made several inches lower than the other, so that the water can be drawn off. With this arrangement the water can be turned in at one end of the trough, and be drawn off and changed as often as desired. The lower end of the trough should be a little deeper than the other, to prevent the water from running over. Each apartment is furnished with a box three feet long and eighteen inches wide. On one side of the box and near one end, is made a round hole two and one-half inches in diameter, and provided with a sliding cover, so that by means of a stick it can be opened or closed from the outside. This is so the mink can be shut up when the pen is being cleaned out. On the top of the box and at the other end should be a door large enough to put in hay for the nest and take out the young. In conclusion, Mr. Stratton expresses the opinion that mink may be kept with remarkable profit in the vicinity of cities or towns, where fresh meat scraps, liver, lights and all kinds of butchers' offal are easily and inexpensively obtained. Still, he continues, the artificial breeding of these and other untamed animals is a mean business, and although there is much money in it if rightly managed, too great expectations should not be indulged in at the outset, because it is a branch of agriculture that requires special study and experience.

Adjourned.

October 12, 1869.

Nathan C. Ely, Esq., in the chair.

Cooking Food for Animals.

Mr. Charles Stoddard, of Auburn, Mohawk county, Iowa, asks what practical difference is there in the value of corn ground and unground, both being well cooked, say to feed hogs? Why does Mr. Young, of Wisconsin, cook his corn in the ear when the same expense will cook just double the quantity of shelled, and the cobs will afford a large per cent of the fuel required? This is my way to cook meal for hogs; if there is a better, I should be glad to know it. I use a cast iron boiler, into which I put the proper quantity of water, and bring it to the boil, at which time there should be no blaze under the kettle; only a bed of coals. Beside my kettle, I have a box into

which I put the meal and moisten it with cold water, to prevent it forming into lumps in the kettle. As soon as the water boils I stir in the meal, shut down the cover and let it stand a short time, when it will be well cooked. It will stick a very little at the bottom, but if the fire is not too high it will not burn, and will clean off easily. I know, for I do it every day. I hold that the value of my corn is doubled by cooking.

Mr. J. B. Lyman.—I may say that an agricultural firm in Philadelphia offered, not long ago, three prizes for papers on the propriety and usefulness of cooking food for farm stock. The first prize was, I believe, awarded to an essay by Mr. E. W. Stewart of Moore's Rural New Yorker, the second to Mr. White, of Windsor, Conn., and the third to Prof. Wilkinson, of Baltimore. These will be published soon. will be largely distributed, and give information on all these points. I am glad of this advance movement. It will help to teach farmers the great loss they sustain in failing to cook food; in many cases equal, I think, to thirty or forty per cent. There is a great, too great, prejudice against this practice, and the publications alluded to will, I trust, have influence to break it down. Some things said in this Club have had a tendency to discourage the use of cooked food for farm animals.

Mr. F. D. Curtis.—This paper is one of especial importance to me. I am convinced that nine times in ten cooking corn is one-fifth, if not one-fourth, better for hogs than uncooked. Probably the reason the gentleman alluded to cooks his corn in the ear is because it is too soft to grind. I had decided to do the same thing, in the absence of any information on the point, to find out by experiment.

Mr. D. R. Prindle, of East Bethany, N. Y.—A few hints at this particular season as to economy in feeding hogs or cattle may be appropriate. Here in western New York, the potato disease seems to threaten a large part of our crop. What shall be done with the best portion of those most likely to be lost, is a question often asked by many a farmer. The prospective high price of corn and other grain is another consideration. Now, it seems to me if farmers would practice a little more economy, and prepare, properly, diseased or small potatoes, wormy windfall apples, squashes, pumpkins, or any surplus vegetables of the farm that would be relished by the hog when so prepared, that a large per cent of corn or other grain usually fed to hogs could be saved. I am aware however, that some learned doctors in your Club teach us that it is " undignified to cook for

animals." To such a man's wife (if he has one), I would advise her to keep the doctor on raw potatoes and other vegetables, and let him take his wheat raw for one week, and I think there will be no trouble in convincing him that cooked food does contain more nourishment than raw, even for four-footed animals. But, to the subject. Cooking corn meal or other dry feed by steam is often attempted in the same way that potatoes or other watery vegetables are managed. A little thought on this point would save the patience of many farmers. As I have said before, dry feed, grain, &c., must have a sufficient amount of moisture to soften as well as heat. Not so with vegetables that contain water. Let it be borne in mind that cut feed must first be wet thoroughly and mixed before steaming, while corn meal, &c., should be cooked in water, and if done by steam (to prevent burning, &c.,) it will require a wooden vessel that will hold water. The importance of steaming potatoes instead of boiling is generally less understood by the masses, and of much more importance, especially at this time, when the tubers are so much affected as to soon decay after being dug. Hence steaming versus boiling is briefly considered here. I have often noted in my practice that, while boiling incorporates the poisonous substance near or in the skin that is well known to exist in all potatoes, steaming largely extracts said substance and poisonous qualities, which runs away (if allowed to) with the condensed steam or water. I have often seen it run some distance from the steam vessel, and of a very dark color, and as I am told, sufficiently poisonous to kill lice upon cattle, &c. Hence the importance of steaming quickly, and rare done, at this time when the tubers are so much affected, as the steam will thus extract a large per cent of those unwholesome qualities. It will readily be seen that if our potato is affected and steamed with others in the same vessel, the good does not partake of the bad, and may be rejected by the hog or even human, provided it is not mashed together. As to the fattening qualities of potatoes, when well cooked, no man of practice or of good taste will deny. For proof of this assertion, without consulting chemistry, see many a poor or Irish family where potatoes are the principal food. When potatoes are not diseased, I usually mash, after steamed, with meal or mill-feed, pumpkins, apples, or any vegetable or refuse that is relished by the animal, and have often noticed that such a variety properly prepared was more eagerly sought after than corn. Hence strict economy in feeding our animals will save millions of dollars to the actual wealth of our country.

Dr. J. V. C. Smith.—Mr. Chairman: It was the opinion of Hudibras that "a man convinced against his will is of the same opinion still." I find in my own feelings confirmation of this principle, for, despite this long letter and this learned talk, I still object to the undignified practice of cooking feed for farm stock. I even doubt if the dissertations which have won the prizes in Philadelphia will have influence in changing my notions. Why, gentlemen, if we get in the habit of going on in the way some would have us go, it will not be long, probably before we will be making shortcake and waffles for our swine. But, seriously, it is, as I have before said, against the great law of nutrition. It is a waste of time, beside, and must have a demoralizing effect on swine and cattle. I firmly believe that the diseased meat brought to this market—and everybody knows the quantity is not small—is largely due to improper practices in fattening. The best western meat is not from animals that were forced to an unwholesome maturity. The feed and feeding of cows has influence on the milk we give our children, and we had better see to it that we do not encourage practices which make the milk impure. I do not wish to have, on this cow subject, what Cowper deprecated, namely, a duel in form of a debate; but I speak for a great principle, and I conclude by saying that animals fed on grass and grain as they find these substances in the material state are best. They have a mill and can do their own grinding. I see I am in a mean minority here, but the side I speak for is the side of truth, and it will, I am sure, be proved so on extended observation.

Dr. Isaac P. Trimble.—I would like to inquire of Mr. Curtis more particularly with regard to his practices in fattening swine, and whether he places corn before his young pigs.

Mr. F. D. Curtis.—I give young pigs each a handful of corn, say twice a week, but their chief diet is milk. When they are older grown, I put a little salt into their food, and I follow this practice up. I also give a small quantity of sulphur every three or four days, also charcoal, and in winter old wood. Raw corn they do not thrive on. My father tried the experiment, and it proved expensive. His grunters grew small by degrees and beautifully less; soon they were stiff and worthless. I also remember that my father used often to have a dozen or twenty porkers, which he fattened on potatoes, boiled; and let me say in this connection to my friend, the ex-mayor of Boston, that hogs will starve on raw potatoes. Another thing, it is a well-known fact that barbarians prefer raw food, and the more

civilized a nation or a people becomes the better they cook their steaks. Practical farmers know that all sort of stock thrive better on grain or roots that are well done.

Mr. Solon Robinson.—I am willing to concede the grounds of the gentlemen that animals thrive best on cooked food ; but the question, and the important question, is: Will it pay, and if so, when and where? In the west it did not prove profitable to cook corn when corn was ten cents a bushel. I remember well that Henry L. Ellsworth, formerly Commissioner of Patents, tested the subject as fully as anybody, and he decided against the practice. As to potatoes, I grant that hogs will not take them raw, but horned cattle will, and the latter fatten twice as fast as when cooked. I dispute the oft-made statement that men degenerate by eating raw meat. They do grow fierce and fond of savage sports, I admit, but it does not injure them physically. On the contrary, they grow strong and athletic. I agree with Dr. Smith that corn in the kernel comes in no questionable shape, but just as nature intended.

Mr. D. B. Bruen.—Ten or twelve years ago this question was brought up in Kentucky, and some distinguished gentlemen, among them Cassius M. Clay, made a report, the gist of which, if I mistake not, was to the effect that there is from twenty to forty per cent benefit in cooking food. I know from my own experience that there is fifty per cent gain in fattening fowls.

Mr. Solon Robinson.—I am familiar with the report alluded to, and there was another side to the story. Some Kentucky feeders, equally influential, brought the best of evidence that they could not make it pay at the prices which then prevailed. In that belief I rest, where corn is less than one dollar per bushel.

GRAPES FROM GREEN ISLAND.

David Thompson, a hale old gentleman, whose eighty winters freeze with one rebuke all who sneer at country life as dull or tasteless, appeared before the Club with a splendid show of native grapes. He spread the table with luscious branches, and suspended others from the walls and chandelier. In response to an invitation of the Chairman, he explained that he offered four kinds; that they grew on his premises in the open air, and many to whom they had been shown supposed them to have been produced under glass. "Here is a cluster" said Mr. Thompson, "which has been handled by probably 500 persons, and I challenge the universe to show such another out of

door grape. The original vine was imported from Germany, and this I call the Carpenter. There is another, by some thought to be better; it has no name. Here is a third seedling, grandson to the Delaware.

F. D. Curtis.—These grapes originated near my place. There, that is, north of the Mohawk valley, we cannot grow the Isabella. The Concord is the best we can ripen in such high latitude. These are the finest grapes I have ever tasted ripened out of doors in the locality in question. Most of the other fine grapes that do tolerably well further south are perfect failures with us. Mr. Thompson certainly deserves great praise for his efforts and our congratulations upon his success.

Solon Robinson.—That these grapes should have been produced in the open air of latitude forty-three degrees is quite remarkable. The better class of grapes do not succeed north of Albany; and if these seedlings are found to do well otherwheres than upon the island, they will be a great acquisition.

N. C. Ely.—It has been thought proper that some set expression be made of the sentiment of the Club collectively on the subject. I will name Messrs. Fuller, Lyman, and Trimble to draw up a resolution. The committee withdrew and soon reappeared with the following, which was read and adopted unanimously:

Resolved, That we have been very much gratified by the display of grapes made by Mr. David Thompson, of Green Island, near the city of Troy. We find that the varieties presented are very promising in appearance and quality, and we are convinced that in the locality where these are produced certain varieties of foreign origin flourish remarkably well, and we suggest that the best seedling presented be called the David Thompson, and that the thanks of the American public are due to this gentleman for his efforts in this department of horticulture.

The Ramie.

Mr. J. W. Gregory read a paper on the subject of this new textile, of which the following is a compend: I have in the past four years made efforts to promote the growth in the south of crops other than cotton, especially of the castor bean and ramie. A sample ot the latter I brought to this Club last year, and presented it with some remarks. I then returned to Texas and Louisiana, and I continued to carefully watch and observe the progress and growth of this new and valuable stranger. On my return to this city, last April, I

brought and presented several sections of the roots and fiber, and have since procured several handsome specimens of the fabric. I also brought a very fine plant, which left New Orleans May 5; but its delicate tropical character was not able to withstand a chilly breeze off Cape Hatteras, although in a good closed state-room. Its leaves fell off and it never recovered. This proved what I before believed, that the region of Savannah is about the northern limit of its growth, and it is consequently more tropical than even cotton. The fabrics referred to have challenged a full share of attention and admiration at the American Institute Fair, and have been critically scrutinized by silk, flax and woolen manufacturers, many of whom have been experimenting successfully in mixing ramie in their respective fabrics. I may here state that, from early samples sent across the Atlantic, and my urging it before the public as a plant of great value, even before the fair opened, I had a number of orders from Europe, amounting to over twenty-one tons, the heaviest from France, for lace and silk manufacturing, and the next from linen manufacturers in Scotland and Ireland. Some from England have since been received. Ramie is an Indian name for the fiber of a perennial plant indigenious to the island of Java, and brought thence to Europe as early as 1844, and experimented on by several manufacturers, who, however, were unable to produce any large supply. Continued experiments by many noted scientific Europeans, including Blume, Belastier, Le Claucher, Fortune, Forbes, and others, convinced them of the superior fineness, tenacity and beauty of texture of this new fiber. It was first introduced in Santa Camapan county, Mexico, in 1866, and thence taken to New Orleans the following year, though only a few plants were then brought. By care, its propagation has now extended to Texas, where it grows very fine, also in Mississippi and Florida, and promises soon to dispute the standing of silk, flax, and even Sea Island cotton. Experiments have already demonstrated that ramie, which only reaches about five feet in height in its native soil, attains nine or ten feet in Louisiana and Texas, and without any perceptible deterioration in the quality of its fiber. There appears a peculiar adaptation in the rich unctious alluvials of the southern rivers, especially the lower Mississippi, to its full development, and the rich and fertile portions of southern Texas seem equally suitable.

Dr. J. C. V. Smith.—This is certainly an important subject, and we ought to be obliged to the gentleman for his paper.

Dr. Isaac P. Trimble.—Mr. Commissioner Capron of the Agricul-

tural Department at Washington has given, and is giving, this matter a good deal of attention. He is sifting its merits, and will let us know the conclusions he arrives at.

Garget.

Mr. B. S. Robinson, of Greenfield Center, Saratoga county, N. Y.—I have occasionally had cows affected with garget, and have never given anything but "garget-root," or "poke-weed" root, as it is commonly known. Several years ago I had a cow affected very seriously with garget. The udder was much hardened, the swelling extending under the belly nearly to the fore legs, no milk could be obtained, and the head had begun to swell. The cow refused all food, even the most tempting. I was recommended to get some poke-weed root and give about four pieces about the size of a butternut, no more, as it was poisonous, and must be given with care. I offered it to the cow, and she ate the prescribed quantity greedily, and kept teasing for more, which I continued to give till I had fed her in a half hour, as much as two quarts. My neighbor was astonished when I told of my doings, and probably thought it a boyish caper, but in two hours my cow began to nibble grass, and in forty-eight hours her bag was in good condition, and in a week she was giving her usual flow of milk. She had but that mess of medicine, and that, or something else, did the work, and I gave her nothing else. Last summer one of my cows was sick with garget. I gave her all she would eat of poke-root; at the next milking she was all right. I find when a cow's milk organs are all right they will not eat the poke-weed root; but when their milk gets disordered they eat of it greedily till they have enough, when they stop, and you needn't try to make them believe its good any longer.

Dr. George Lee, Barre, Mass.—I notice that Dr. Trimble can hardly conceal his contempt for so simple a cure as poke-root. It is not best nor wise for doctors and clergymen to be much bigoted or dogmatic in their professions. There is science, philosophy, or truth not yet understood nor dreamed of by our best philosophers. Now the evidence is overwhelming that a piece of garget or poke-root inserted under the skin of the breast of cows will cure the garget. It may thus cure from counter-disease or irritation, or by absorption of the medicine into the blood and lymphatic vessels, or circulation, so as to act specifically upon the diseased gland by either a chemical or

dynamic power. It is often inserted in the breasts of horses to cure glandular diseases about the throat.

GREAT YIELD OF POTATOES.

Mr. C. Simons, Bloom, Wood county, Ohio.—I took just one pound of Early Rose (four tubers), and cut them in about fifty pieces, one eye to each piece, and put them in a box to sprout about the 1st of May, transplanted them (260 sprouts) between the 1st of June and 4th of July, putting one sprout in each hill, in a rich sandy soil, and produced, by actual weight, 751 pounds, or twelve and one half bushels of good large potatoes, the heaviest weighing two pounds seven ounces, and from the best hill (one sprout) I got six pounds four ounces large potatoes; the hills were one by two feet apart, and from one piece of ground sixteen by eighteen, I got 285 pounds, at the rate of about 760 bushels to the acre.

HOW TO KEEP CAULIFLOWER.

Mr. J. M. Sterling, of Kiantone, Chautauqua county, N. Y., wrote to inquire concerning the preservation of this vegetable during the winter, and he would also know, "can they be preserved for spring use?"

Mr. P. T. Quinn.—They can be kept during the early part of winter by covering the roots and part of the stock with soil in the cellar, or in frames under glass or boards. I have kept them as we do Savoy cabbage, that is, making a trench twelve inches, and covering the stalk and part of the head with earth. Then place four or five inches of hay or straw over the surface.

Adjourned.

October 19, 1869,

NATHAN C. ELY, Esq., in the chair.

POUDRETTE.

Mr. Arthur Vickers, Coaticooke, Province of Quebec, Canada, solicited information as to the proper mode of preparing night-soil for agricultural purposes. The information will be, he says, of great value to the people of his section.

Mr. J. B. Lyman.—It is easy to say that muck will answer, which is true, or that garden soil will answer, which is equally true; but doubtless the simplest and most convenient and best thing is chip manure—an article which most farmers have in abundance. When

taking out the contents of a vault he wants some stuff to deodorize; carbolate of lime is good, sulphuric acid or sawdust, ashes and plaster mixed, or sour swamp muck dried.

Mr. W. B. Bunnell.—I have had experience in this matter for many years past, and have been best satisfied with the use of dry earth.

The Curculio.

The Chairman said that the gentleman who last addressed the meeting had been giving special attention to this pest of the fruit-growers. Mr. Bunnell said, in reply, that he had battled with the enemy for a score or more of years. He had tried everything, bought all the nostrums, but had not found relief. The best success attended the practice of smoking half the tree and not the other half. Smoking half seems to drive the enemy over, but when the whole is smoked he survives and rallies. But now, continued the speaker, I have a cure, all of my own invention, which is cheap, easily applied, and which, I am free to confess, I hope to make a little money on. Mr. Bunnell then showed some specimens of quinces picked from a tree which had been treated after the manner of his patented process, and which were comparatively free of stings.

Dr. Isaac P. Trimble.—The curculio that attacks the quince does not trouble other fruit; therefore, what prevented its ravages might not be equally efficacious on plum trees. A friend of mine was comparatively exempt this year, because last year he picked his quinces and put them in barrels, and kept them standing for some time. When he removed them at last, he found many curculios in the botton of the barrels, and these he killed of course, and thus he lessened the number. The principle is a good one. Ten thousand people in Vineland have proved it so during the past season, and I question if any one will find a better way,

Mr. P. T. Quinn.—The curculio is a bothersome insect, even in a pear orchard. I know Mr. Bunnell, and have confidence in him, but the remedy should stand the test of years. The only remedy I know of at present was known and practiced before our day, namely, the jarring process, and the gathering of the affected fruit that falls. This has given great relief in Vineland this year, but it did not remove the enemy.

Dr. J. V. C. Smith.—This topic is one of great interest and if our friend has a remedy, he has it in his power to confer an immense benefit upon the country, and I hope he will make it free as air, and not

a close monopoly. The glory of heading off the enemy would, it seems to me, be enough for himself and his posterity. However, if it really is a good thing and the money consideration will not be foregone, I would gladly head a subscription with $200, so anxious am I that the depredations of the pest be stopped.

Wet Cellars.

Mr. A. C. Shumancy, of Hallock, Ill., gives the following account of his grievances: My cellar is on a level ground and difficult to drain, I have a cement and gravel wall and bottom which are quite hard. the latter ten inches thick, and yet the water comes in through the bottom. It seems the pressure is so great that it forces the water through the pores. Now what can be done? I cannot drain. Will coal-tar, applied cold or hot, fasten so firmly to the bottom as to keep out water, or is there something better? If you can give us a little knowledge on this you will confer a favor on several men in the same condition.

Mr. A. S. Fuller.—A coat of water lime might have the desired effect. However, it is more than likely that the trouble is lack of proper ventilation. The water condenses and drips down. I have a cellar cut out of solid rock, and unless aired every few days it gathers dampness in the same way as our correspondent describes. We might, if we choose, get a lesson from this of the benefit of mulching. The deep cool earth is a great condenser of the moisture in the air, and if you allow the atmosphere to penetrate to the depth of a foot or more, it will supply moisture on the same principle that cool cellars are very apt to be damp cellars.

Mr. F. D. Curtis.—My cellar was damp, and to remedy the evil I took down the wall and laid it in mortar very thoroughly. Still the dampness continued. This summer I coated it all over with cement, but it is still damp. I am persuaded that the real cause is explained by Mr. Fuller.

The Early Mohawk Potato.

Mr. Reuben E. Moss, Elmira, N. Y.—Will the Club have the goodness to inform me of the origin of the potato sold as Early Mohawk, in New York? I should like to know if they are identical with those raised about here; thinking the seed might have been carried from Elmira to your section; and you will much oblige an old and a constant reader of the proceedings of the Club.

Mr. S. B. Conover, of Washington Market.—This potato origi-

nated in Michigan, in 1864, by Lewis H. Brown, from a ball of the Peach Blow, the bloom of which had been impregnated with the pollen of the Buck Eye, from whom I obtained the seed three years ago, and gave them a thorough trial for two years previous to the spring of 1869, when, being well satisfied of its earliness and strength of growth, and superior quality, I concluded to have them most thoroughly tested by the public throughout all sections of the country, and if they still maintained their character, to offer them to the public for sale this fall. In order to have them thoroughly tested in all sections of the country, by disinterested and trustworthy persons, I refused to sell any of them at any price, but sent them out in packages of five and six potatoes, by mail, post-paid, to the presidents of all the county and town agricultural societies that were reported in the last edition of the Agricultural Report of the Patent Office, with circular accompanying each package, requesting that they try them against all the other varieties of potatoes in regard to earliness, strength of growth, yield and quality, and report to me this fall. From the large number of letters received up to this time, I feel no hesitation in offering the Early Mohawk potato to the public as the very best, without exception, of the new varieties offered, and one which will not only answer as an early variety, but one which from its large yield will take the place, for a winter and spring potato, of the long and well known white and red Peach Blows, which are fast becoming an uncertain crop. This potato sends up a stout vigorous stalk, branching out above ground, taking the form of a bush, growing about one and a half to two feet high, of a very dark green foliage, rather inclining to make top before the potatoes set, but after setting, they increase in size very rapidly, the tubers grow away from the stem, from three to six inches each way, setting from eight to ten potatoes, which grow uniformly of large even size, and good shape; the vines mature and die evenly, and at the same time; the tubers are of oblong, roundish shape, with rather square or flattened ends. The flesh is white, the skin of a very light pink or russetty white, with prominent pink eyes, but little sunken, the potato being very heavy and solid, and never hollow inside. All parties who have tested this potato by cooking, say that it cooks white, dry and mealy, and the flavor is superior to any that they ever have eaten.

WIRE FENCES.

Mr. J. H. Stanton, of Clyde, Iowa, asked the Club for its views on this subject: "Will wire make a substantial and durable fence, and

is there any tightener that will adjust itself to the expansion and contraction of the wire? In this prairie country it would have two advantages over boards: First, the wind would not rack the posts; second, the snow would not blockade our streets in winter."

The Chairman.—This subject has been considered here at length on more than one occasion, as our correspondent will see if he refers to our files. What has been said, if I remember aright, was not favorable.

Mr. F. D. Curtis.—In my section of the State wire fences have been entirely abandoned. There are various good reasons why this should be so.

HOW TO PRESERVE GRAPES.

Mr. Alexander Palmer, Modena, Ulster county, N. Y.—It is really very desirably to be able to enjoy the luxury of having fine grapes on our tables during the winter. And the best way to preserve them, according to my experience, is to take good clusters of perfectly ripe fruit, and, after sweating them in baskets a short time, wrap each cluster in two thicknesses of clean white tissue paper, and pack them in clean, tight boxes four inches deep, holding about half a bushel. Some varieties will keep well in this way till April.

A CORN CATERPILLAR.

Mr. J. H. Wood, of Wallpack Center, Sussex county, N. J.—Inclosed I send for your inspection some worms that infest our corn. They are quite numerous, upon the leaves only, which they eat nearly up. They get upon our hands, and cause the flesh to raise up in blotches; their effect upon the flesh is similar to that produced by nettles, and cannot be got rid of for some days. The species is new to us, and we would like to have the opinion of the Club about them, whether they are poisonous to cattle or not.

Dr. Isaac P. Trimble.—This letter, with the specimens enclosed, was referred to me at a previous meeting. The specimens were somewhat dried, but I was able to ascertain the species, and have made rough drawings, as you see. The supposition that it is a caterpillar—for it is a caterpillar, and not a worm—is natural. If it touches the skin it produces, as our correspondent states, the effect of nettle, though it lasts longer. The idea that it is injurious to cattle is a new one to me, and probably untrue, because the caterpillar leaves the corn before the leaves come.

Adjourned.

October 26, 1869.

Mr. Nathan C. Ely, Esq., in the chair.

Dry Cellars.

Mr. S. E. Todd, of Brooklyn, communicated the following directions: He said he recently had occasion to examine several cellars, the bottoms of which are below the surface of the East river, and which aforetime were always so wet, at high tides, as to be unfit for even a store room of any kind. But they were rendered satisfactorily dry for eating saloons simply by covering the sides and bottom with a heavy coat of the best hydraulic cement, and after it had dried applying an overcoating of plastic slate material. The plastic slate should be spread on, while warm, with a plastering trowel, just as a wall is made in a dwelling-house. Any cellar that cannot be drained may be rendered perfectly dry by cementing the sides and the bottom, and covering the cement with the plastic, made of coal tar and slate flour, both of which can be obtained at a trifling expense. If the correct proportion of tar and slate flour be mingled together, the material will be as impervious to water as one unbroken piece of Vermont slate, sufficiently large to extend over the entire cellar bottom. If the work be properly done, the bottom and sides of the cellar will be as water tight as a jug.

Seedling Potatoes.

Mrs. L. B. Carter, Southfield, Mich., wrote that she has over a bushel of potatoes raised this year from this seed, and this she would like to know: Whether to sort them or plant them together another season. Also, will potatoes planted side by side mix?

Mr. J. W. Gregory.—In answer to enquiry number one, I would say our fair correspondent had better plant the best and reserve the others, as the latter may prove to be very poor.

Mr. D. B. Bruen.—And in reply to question number two I may say yes. I could if time served, give you an interesting experience relating to certain potatoes which came over from Dublin, and which established the fact that varieties will amalgamate.

Corned Beef.

Mr. E. Folsom, Bloomington, Ill., is sure that whoever tries the following plan will never want any other: For 100 pounds beef, three buckets of water, or enough to cover the meat; four

pounds brown sugar, with as much salt as will dissolve. Boil and skim. Put in the meat while boiling; boil thirty minutes; take out and cool; pack in barrel and turn on pickle when cold. Beef packed after this recipe may need a little more salt after the month of March.

Mr. Nash Elder, Huntington, Loraine county, Ohio., gives his recipe for putting down beef: For 100 pounds meat, take four quarts rock salt, four pounds brown sugar, four ounces saltpetre, pulverize, mix thoroughly, sprinkle a layer half an inch thick in the bottom of a barrel, pack a layer of beef close down upon it, and pound it close with a wooden pestle, cover with the mixture, pack another layer close, and so on. The moisture of the beef will make a brine that will keep the beef any length of time.

Mr. H. Gortner, Nashport, Ohio, forwarded the following directions, which he knows by experience to be worthy of confidence: Now would you know how best to treat your beef, to keep it fresh and sweet, then take to each 100 pounds, four quarts of salt well heaped and round, and six red peppers, sure not green, saltpetre too, an ounce and a half, but put these all in water pure, of just four gallons good and true, then boil it slowly, skim it well, next let it cool a goodly spell; now have your beef well packed, and nice, pour on the brine, it will suffice, if well you keep it weighed down, to sweetly keep the whole year round.

"DRENCHING" CATTLE.

Mr. G. H. Nelson, of Alba, Pa.—Having seen a recommendation for drenching cattle which I think both inhuman and unsafe, I will give you my experience in the case. My method is to tie the head as high as convenient, then take the creature by the nose with the left hand, and raise it so that the mouth will be somewhat elevated; then take a bottle with a long neck and run it into the side of the mouth as far as convenient, but not between the grinders; then let the drench run into the mouth; the creature then, with the free use of the tongue, will swallow it as fast as it comes. This method is, I think, much better than the ordinary one of drawing the tongue out to its full length, which is, to say the least, cruel, and as it deprives them of one of the natural (I might say most useful) organs of swallowing, it endangers their lives from strangulation. An ordinary cow I can drench in this way in an open field without any assistance. It will cost no more to try it, and if it does not succeed it will be time enough to draw the tongue.

Long Island Lands.

Mr. John R. Havens, of Patchogue.—Among the many calls that are made to the attention of persons residing in the Eastern States and other parts of the country, allow me to add one in behalf of "old Long Island," in the matter of where they shall invest their capital to the best advantage. Now, it is true that, so far as is generally understood by the word "farming," this central part of the island does not occupy the front rank. And yet, with the facilities we enjoy for obtaining manures in the way of Irish sea weed, and many other fertilizing substances furnished by our bays and creeks, we think, so far as profits are concerned, it compares favorably with other parts of the country. And, by the way, while speaking of our bays and creeks, that in many cases pass by our very doors, I presume I am safe in saying that no people in the world are more highly favored as regards fish, oysters and clams. Here is the abiding place of the world-renowned Blue Point oyster. But the greatest inducements now held out, and interesting more particularly to men of capital, are cranberry culture, water-cress culture, and more especially the culture of brook trout. Fortunately, as regards these three last named, this part of the island is most peculiarly adapted, from the fact that it is one continuous intersection of the finest brooks, from which our town derives its harmonious and very appropriate name, Brookhaven.

In almost every case water-cress has been found growing spontaneously and in no instances have we failed to find that greatest of luxuries, the speckled trout, showing beyond cavil that these brooks, are natural to their production. One of the great advantages we enjoy over most other parts of the country, as regards the culture of cranberries, water-cress and trout, is that what are called freshets are not known. As regards the price of lands necessary for the above named purposes, it usually ranges from ten dollars to twenty-five dollars per acre. Now, to illustrate our ideas to success in the use of swamp lands, we will briefly describe the operations of a friend of ours here in Patchogue. He first selected a brook already (as is usually the case) stocked with trout. This brook, as a type of all the rest, is bounded on each side by a gently rising slope of from fifty to 100 feet. From the base of this slope to the margin of the brook is an average of from fifty to 100 feet of muck bottom, perfectly adapted to the culture of cranberries, from ten to fifteen acres of which he has already in successful operation, and four acres of which

he has lately sold for $3,500. In a certain part of this muck bottom he has cut artificial canals and set out water-cresses, which has proved a perfect success. But prominent in his operations is a spawning race, two feet wide and 350 feet in length, built upon the most approved principles, with a capacity for spawning half a million of fish annually. Now, all who have the least knowledge of the value of this speckled favorite can form some estimate of what the result must be in dollars and cents. This village is the terminus of the South Side railroad, only two or three hours ride from the city of New York. Now, we think it will pay parties interested, before going thousands of miles west, at a proportionate expense, to take a look this way.

Dr. Isaac P. Trimble.—I like the tone of this letter very much, and I hope the story is all true. I shall try to get over there next year and see for myself. I saw something of the people and products of Queens county a while back. The occasion was the annual fair, and I must say I was very much surprised to find so fine a display. Why the country is not cultivated, is a conundrum which I cannot solve. But the fact remains that Long Island cannot compete with New Jersey, and the reason is the latter has marl, and has it handy. Monmouth county was once as barren as any part of Long Island, but the free use of marl has brought it up to high fertility. However, I am told that they are transporting this fertilizer to the island, and if it is found to act well on that soil, there may be large hope in the future for the scouted section.

The Chairman.—This letter does certainly, as Dr. Trimble says, make an enticing picture. Think of it, ye epicures; brook trout and cranberry sauce! But, seriously, it is my humble opinion that fifty years hence, Long Island will furnish New Jersey with fish and fowl. Then the former will be one great garden and the latter will be all dotted over with manufacturing towns and villages, and the inhabitants will be working under roofs. Then they will look for food languidly and confidingly across the bay to "old Long Island," and they will not look in vain.

Mr. J. W. Gregory.—I foresee that in those halcyon days a great controversy is likely to arise. New Jersey will be saying, "Long Island is ours, for, verily, was not our marl effectual in the building up thereof?"

Mr. Wm. Lawton.—Mr. Chairman and gentlemen: You all do know that our friend, the entomologist, of New Jersey, is no lover of Westchester county; he has been there, and says he don't like the

section well enough to repeat the visit, and he says other things less complimentary. Well, now (since a little gratuitous advertising of localities does seem to be the order of the hour), permit me to note, incidentally, the strange anomaly that this same wretched Westchester, where (according to the entomologist) we cannot grow apples because of moths, where (according to the same authority) we cannot grow quince, or cherry, or plum, or pear, because of the frisky curculio; where land is poor and the gardens weedy wastes, thousands of deluded mortals are constantly flocking, and farms are advancing from $100 to $500 per acre, and frequently to $1,000. I would certainly be delighted if Dr. Trimble would, some time during the next ninety days, give the subject the grave consideration its merits demand, and tell us, if he can, how all this happens to be thus.

Bots in Horses.

Mr. D. Washburn, Marion, Ohio.—I have been a little amused, and with interest, too, at the various arguments on the causes and cures of bots in horses. Not being as well versed in the matter of cause as of the cure of a disease called bots, I, therefore, for the benefit of others, will give a cure, which I have never known to fail, and have administered it to several horses, but I don't think it or any thing else will do unless given in time. My cure is: A piece of alum the size of a walnut dissolved in one quart of water, and drench afterward. It is well to loosen the bowels. I have never had to give the second dose.

Dr. Isaac P. Trimble.—I question the sense of all this. Not long ago I talked with a veterinary surgeon, who stated that the trouble arises from the fact that the stomach becomes empty, and the bots then attack it for want of other substance to feed on. I remember seeing a horse's stomach opened once, and it bore the evidence of having been eaten by this enemy. The surgeon alluded to said the proper remedy is to keep the stomach well filled. Sweet apples are best, and if the horse is too sick to eat, administer sweetened milk.

Dr. J. V. C. Smith.—The best authorities tell us the bots cannot live when freed from the side of the stomach to which they attach themselves. They do not feed on the food of the horse, but upon the fluids of the muscus coat of the stomach, and when once there, there is no remedy that will hasten their excommunication, which is sure to take place in due course of time.

Prof. J. A. Whitney.—As I have before said, here the simple

question is how to prevent the enemy from gaining access to the stomach. I do not think that any horse ever died of bots that had a baiting of raw potatoes twice a week. It is found that the juice of potatoes is fatal to oats, and this fact would serve to militate against the theory of Dr. Smith that his exit cannot be hastened. Molasses and milk are good, but the better way is to keep the horse clean and remember the potato prevention.

Mr. J. W. Gregory.—I may have said on a previous occasion what, at least, is worth repeating, that a spoonful of chloroform (which is easily given with milk and molasses) has been known to have the desired effect.

Mr. A. S. Fuller.—A dose of tobacco is sure pop. My father tried it often and never failed. In our neighborhood, in my boyhood days, there used to be two classes, tobacco-men, and milk and molasses-men. My father belonged to the former, and his success was as I have said. Since that time I myself have given tobacco a dozen times and found it a safe cure.

WEEDS.

Mr. Edgar G. Smith, Troy, Morris county, N. J.—We are practical farmers hereabout, and consequently enemies of weeds. Of the most noxious that intrude in our vicinity are the sample that I inclose. Its botanic name I have never heard; it has many local, and, believing you might not recognize any of these, forward this, the black plaintain, daisy, wild carrot, and Canada thistle. The daisy is considerable, but is easily cured by the plow and a good barnyard, as grass is our staple. The other three are kept in subjection by all who will (on all occasions when about the farm) use a bright eye and a good stiff thumb and finger; thus many farms have but little, keeping them few while they are few. If certain spots have escaped and got a little start, a dose of salt has proved a cure. A neighbor has a patch of the kind of which I enclose a specimen, and, believing the salt a panacea, used it several seasons in vain. The other day I met him near the ground, and feeling anxious that it might not extend its domain and get on my side of the fence also, suggested this plan, to address you. If you can give us some remedy you will much oblige. N. B. I forgot to mention that the pick and shovel are of little use, for a peculiarity of the plant is, if one of its innumerable little hairy roots is dropped on the ground, it will take hold and grow as well as corn that is coaxed.

Mr. A. S. Fuller.—The weed, botanically, is *Linaria vulgaris* and besides the names mentioned by our correspondent, it is known as "toad-flax," "butter and eggs," &c. Its existence indicates good land, but, as stated, it is a great pest to get rid of, even worse than Canada thistle. It grows from Maine to Mexico, and the only remedy is to keep the land thoroughly cultivated.

Grape Cuttings.

Mr. Y. T. Graham, Rockford, Ill., would be advised as to the proper time to gather them, now or later in the fall, or next spring.

Mr. P. T. Quinn.—It is found to be as good a practice as any to cut in Autumn, put in bundles, "heal in," in sand, and put out the following spring.

Potatoes.

Mr. George Stanville, of Fairport, Monroe county, N. Y., asked the following question: When hay is worth fifteen dollars per ton, corn one dollar per bushel, and oats fifty cents per bushel, what is the value of potatoes for feeding purposes?

Dr. F. M. Hexamer.—I should say fully twenty-five cents per bushel, and in the New York market this year, and in other markets, the price is likely to be less than that. In my opinion, potatoes are used too little as food for stock. Though not so nutritious as grain, they answer a good purpose. I experimented with cows, and at the market rate at that time I concluded potatoes were worth fifty cents per bushel, while grain did not pay me one-fourth its cost.

Tobacco.

Mr. Henry Jones, Greentown, Penn., solicited information as to the best mode of curing the weed, and particularly whether artificial heat is advisable.

Mr. A. B. Crandell.—Two or three years ago, Orange Judd published a valuable prize pamphlet, in which he detailed, in a condensed way, the experience of fourteen practical cultivators residing in different sections of the United States. Although some counsel the use of fire, still the weight of testimony is against the practice. Where the facilities are sufficient, it is found that better results attend the plan of relying wholly upon the absorption and assimilation effected by the atmosphere alone. However, in certain cases, for instance when the weather is excessively damp and rainy, or when too large quantities are stored in a close house, it may be necessary to resort to

artificial drying to save the crop. Under such circumstances it is recommended that a flue of mason work be made across the floor of the building covered with sheet iron, and leading from a furnace outside the house on one side, to a chimney at a safe distance on the other. A trench is sometimes dug, and a log or two of wood placed in it and fired; but this gives the tobacco a smoky smell and taste that is not much liked by buyers. Other objections are: Cost of labor and of wood, and the risk of losing both tobacco and building. A better practice is to have stoves, with pipes to convey the smoke (which is of no value in drying), outside the house. With this arrangement, the heat may be safely kept at eighty or ninety degrees. But, doubtless, the better plan, especially for a beginner, is to run no risks, have plenty of room, hang the crop thin in houses not too large, having windows and doors sufficient to admit light and air freely in pleasant weather, and by closing them in bad weather to exclude rain and dampness, which have bad effect on the color and quality of the crop. The Cuba grower would force the drying in wet weather and retard it in dry weather, as either extreme is, in his opinion, injurious. Left to atmospheric influences alone, the curing requires, in ordinary seasons, about three months. By the exercise of a little judgment one will soon learn to know when the process is complete. There should not be the least greenness of color or scent about the stalk, the stem, or any portion of the leaf; and the stems should be so brittle that they will snap short when bent in dry weather.

BROOM CORN.

Mr. A. McKnight, Galesburg, Ill., having seen some questions on this subject from a Club correspondent, forwarded the subjoined facts and figures: If the inquirer wishes to raise fifty acres he will need two span of horses, $500; two wagons with racks, $250; two sets harness, eighty dollars; two plows, forty-five dollars; two cultivators, eighty dollars; two harrows, thirty-five dollars; one roller, forty dollars; one scraper, $225; one power and fixtures, $150; one press, seventy-five dollars; one planter, ninety-five dollars; shed, twenty-four by eighty, with ribs and lath to dry on, $300. The usual way of putting in the crop is: Plow, roll, harrow, and then plant in drills, five rows to the rod, with the seed two inches apart in the rows. When up, roll, harrow, running wide end forward, till large enough for cultivator. Then cultivate, and don't be afraid to do it often. When ready to harvest, that is, when in the blow, table by breaking

two rows across one another, two feet high, and laying the cut corn on every other table; drive team over empty table, with man on each side to hand brush to loader. With two teams and four men to haul, and two teams and twelve men to scrape and lay up, from one to one and a half tons can be put up in a day. When dry, bulk, after sweat, bale; four men can press three tous a day. The seed is worthless, being green; if ripe, brush ditto, or, in other words, red corn won't bring a price so it will pay to let get ripe; cutting four dollars to six dollars per acre. Help, $1,25 to $1,50 per day; farm hands, eighteen dollars to twenty-five dollars per month; yield, a ton on from three to eight acres.

Sawdust.

Mr. S. M. Meaker, Fowler, Trumble county, Ohio.—I have bought 300 grape vines. My ground is underdrained with tile, clay loam, descending south. I propose to trench twenty inches deep and the same in width, and fill up with rotton sod that was plowed last spring. Now, what I would like to know is, whether it would hurt the vines to put rotted sawdust made of whitewood and white oak to fill up the trench, say a bushel to a vine? Would there be so much acid as to hurt the vine, provided the roots did not come in contact with the sawdust?.

Mr. A. S. Fuller.—I would not want to trust it. He had better not experiment on young vines.

Mr. H. Greeley.—I suppose his land is close, and that he wishes to lighten it. I question if he will have very great success with grapes on clay, but the sawdust mixed through the soil may help matters some. I should think this the better way to dispose of it, and thus used, it seems to me, it would be valuable.

Dr. F. M. Hexamer.—He had better use his sawdust for bedding in stables, and apply it to the soil afterward. If his land is heavy he would find it advisable to trench it.

Roofs for Buildings.

Mr. Thomas Snyder, of Rockport, Indiana., wrote to inquire about the asbestos roofing answering a better purpose than shingles, and would it prove cheaper in the end?

The Chairman.—I should say it would depend entirely on the price paid for either, and we cannot be expected to judge, since the figures are not given.

Mr. William Lawton.—I can say for my part that I want nothing better than cedar shingles. I have on my place some shingles put on sides of buildings in 1776, and they are good still, and on roofs they last at least fifty years. These shingles have been kept well whitewashed.

The Chairman.—I have on my place a painted roof, put on in 1824, the very day that Lafayette landed here, and it is still in good condition. It is well known that the color had better be light and not dark, because the latter attracts the heat more than the former.

Dr. J. V. C. Smith.—I once listened to a Frenchman in Paris, who talked long to a company of his distinguished countrymen, and convinced them, as he did me, that to paint shingles is great economy. I am glad to have this opinion confirmed by what I hear in this room to-day.

Mr. D. B. Bruen.—But there is something more to be said. There is a house in Newark, I have seen it frequently, it was built before the revolution, and the shingles with which it is sided are apparently as perfect to-day as they ever were. Of course, they have always been kept well painted.

Prof. J. A. Whitney.—It is also a good method to treat the shingles to a solution of sulphate of iron, as railroad ties are treated in England.

PREPARING CELERY FOR MARKET.

Mr. P. T. Quinn.—Every cultivated plant has its special characteristics which become familiar to those who study the laws of vegetable physiology. The practical farmer, knowing these facts from observation and experience, will lay out his garden with a view to give each kind of plant the exposure and locality most congenial to its habits of growth. Again, it is a fact well known to market gardeners that each kind of vegetable, to command the highest price, must be prepared in a certain way, and if the arbitrary rule is not strictly adhered to, the produce will not bring half its market value. There appears to be no obvious reason why nine long raddishes tied in a round bunch, are not as good as the same nine tied in a flat one, or why three or four stalks of celery made up into a round bunch are not as palatable and in every way as good as when made into a flat bunch. Still, in the one case, they will find plenty of customers at the best market rate, while in the other there is no demand, and would not bring enough to pay expenses.

The methods in general use of preparing certain kinds of vegetables for market are expensive and laborious to the producer. While talking on this subject a few days ago, a market gardener told me that it was more trouble to prepare for, and market some kind of "truck" than it was to grow them, and named celery as an instance. The bulk of this crop is sold during the winter months, and gardeners spend nearly all their time, from the middle of December, until the middle of March preparing celery for market.

In the latter part of November, the celery is dug and placed in trenches, where it is bleached and protected from frost. Bleaching is sometimes hastened by pouring warm water into the trenches on a mild day, and then replacing the hay, straw, or hog manure on top of the trench.

When the heart of the celery is sufficiently bleached and the demand is good, the stalks are taken in winter from the trench to the market house. This building is provided with a stove, boilers for heating water, and a large wash tub and two tables arranged on either side of the tub. The stalks are then trimmed, which consists of taking off some of the outside leaves so as to expose the heart. The root is then shrived off with a long bladed knife, leaving four flat sides tapering a little toward the end of the root. The operator then cuts a narrow circular groove about the same position on each root to facilitate tying.

The stalks, which were sorted at the time of trimming, and then placed in the wash tub, and with plenty of warm water and a scrubbing brush the celery is thoroughly cleansed, and placed on the table for bunching. This latter operation requires the most skill and practice, and a gardener who is expert at bunching celery can always command higher wages on that account.

The bass matting or twine is cut the proper length, and fastened in a convenient place near the person bunching, who stands in front of the table. Three or four stalks are selected for each bunch, according to the size of the celery. These stalks are arranged to the best advantage, and the roots of all are tied closely together, by making a single knot around each, except the last, which has a double or fastening knot, care being taken to have the outside stalks trimmed nearly alike, so as to make the bunch fined shaped. The tops and all the small stocks are made into round bunches, and sold to the Germans, at a low price, for soup celery.

A person who is expert in bunching will tie four or five dozen an hour, day after day, for weeks at a time, working day and night, I might say, for the market gardener seldom gets through his work in "celery time" before nine or ten o'clock at night. The morning is usually devoted to getting in the celery from the trenches, and the afternoon and evening for trimming and bunching.

When the day's work in bunching is finished, the bunches are counted and carefully placed in chests made expressly for the purpose. These are then placed on the market wagon and sent to market at nine or ten o'clock at night.

The man and team are out all night; in fact this happens four and five nights of each week, rain or hail, for nine months of the year, with the market gardener in the vicinity of New York.

Adjourned.

November 2, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

THE SILESIAN SUGAR BEET.

Prof. S. D. Tillman read the following paper, which was listened to with close attention: From an article covering nearly thirty pages in the "Journal of the Royal Agricultural Society of England," "On the Chemistry of Silesian Sugar Beets," by Dr. Augustus Voelcker, I have gathered the following interesting information: All the varieties of sugar beet may be considered as belonging to one of five chief sorts, viz.: 1. The French or Belgian sugar beet. 2. The Quedlinburg (German). 3. The Silesian. 4. The Siberian. 5. The Imperial. On the continent the white Silesian beet is the kind most approved. It does not contain so large a precentage of sugar as either the Belgian or the Quedlinberg, yet it yields a larger weight of roots per acre, is of a more vigorous growth, and produces a larger amount of sugar per acre. Good sugar beets possess the following characters: 1. They have a regular pear-shaped form and smooth skin, carrot-like; long, tapering roots are considered inferior to pear-shaped Silesian beets. 2. They do not throw out many fibrous-branched roots or forks. Forked roots are difficult to clean, and not so readily pulped as well-grown, symmetrical, pear-shaped roots. 3. They have a white, firm, and dense flesh, and clean, sugary taste. Such roots are readily reduced to a fine pulp by proper machinery. Soft and

spongy, thick-skinned roots are always more watery than those of a uniformly firm, hard, and close texture. 4. Good sugar beets generally weigh from one and a quarter to two pounds. Very small or very large roots are not usually so well suited for the manufacture of sugar. Roots weighing under three quarters of a pound are frequently woody, and, beside sugar, contain to large a proportion of other constituents, which prevent in a large measure the extraction of crystallized sugar from the juice, while roots weighing more than two and a half pounds are generally too watery, and too poor in sugars. 5. Good sugar beets always have small tops, and no tendency to become necky. 6. They do not show much above ground, but grow almost entirely in the ground. Roots, the tops of which grow above ground, do not yield so much sugar as others that bury themselves better in the soil, for the heads of the roots, being exposed to light, turn greenish and yield less crystallizable sugar than the parts covered by the soil. Manufacturers of sugar cut off the greenish-colored heads of the roots before they are pulped, and hence much waste takes place when beet-roots grown, in a large measure, above ground are sent to the manufactory. Generally speaking, the higher the specific gravity of a beet root the more it is esteemed for its sugar-producing qualities. Good roots are considerably more dense than water, and rapidly sink to the bottom of a vessel filled with water. The expressed juice of good beet roots has a clean, sweet taste, and a specific gravity of from 1.060 to 1.070. When very high in sugar, the specific gravity of the juice rises above 1.070, reaching occasionally 1.075 to 1.078. On cutting a beet root across we shall see that it is composed of concentric zones or layers, differing in color more or less, according to the variety. The exterior, or skin, is composed of compact cellular tissue. Next will be seen concentric zones, the number of which corresponds with that of the several circles of leaves forming the tops, and the breadth of which depends on the stage of development of the leaves. The oldest and most external leaves are in direct communication with the oldest and most central layers or zones, composed of cellular and vascular tissue, while the youngest and most central leaves communicate with the most recent external concentric zones of the root, and provide them with nourishment. If the leaves of a beet root are very large and luxuriant, the concentric rings of the root with which they communicate will also be found very large, the tissue of their rings spongy, and the cells large and filled with sap, that is, comparatively

speaking, watery and poor in sugar. On the other hand, the less luxuriant and smaller tops of well-grown, moderate sized beets will be found to correspond with concentric layers of cells of smaller dimensions, to be filled with a denser sap, richer in sugar than we find it in roots with large tops. The best roots for the manufacture of sugar are those in which the size of these concentric layers of cells does not exceed one-eighth to one-quarter of an inch, and, as a general rule, such roots do not weigh more than two pounds each. The walls of the cells are composed of cellulose, and upon this is deposited a gelatinous matter called pectose, which occurs in all bulbous roots, and in fruits from which jelly can be obtained. Beside cellulose and pectose constituting the bulk of the expressed pulp of the beet root, the latter contains small quantities of soluble albuminous compound and insoluble mineral matters, chiefly composed of insoluble salts of lime. The liquid contents of the cells, or beet-root juice, contain in addition to the sugar, their chief constituent, an appreciable amount of vegetable casein and analogus nitrogenous compounds, a little green coloring matter, oil, a peculiar acrid-tasting substance which has not yet been satisfactorily isolated, citric and probably other organic acids, and a number of saline compounds which constitutes the soluble portion of the ash of beet root. Dr. Voelcker gives seventy-eight analyses of Silesian beets, from which we find the average amount of crystallizable sugar is between eight and nine per cent of their weight. The highest per centage was 13.19, and, what is remarkable, the lowest per centage, 2.22, was obtained from a very large root, to force the growth of which more than the usual quantity of common manure had been applied. Like other green crops, the sugar-beet, though not equally well adapted for every kind of soil, is nevertheless grown on land varying greatly as regards depth, texture, and general physical and chemical properties. It may, however, be observed at once that all soils incapable of being cultivated to a depth of at least sixteen inches, are unsuited for the growth of the sugar-beet, which, unlike the yellow globe mangold, grows almost entirely under ground, and therefore cannot be cultivated with advantage on very shallow soils. Peaty soils are not suited for beets, nor still clay soils, and, more or less, all soils in a bad condition are unsuitable for its cultivation. The chief requisites in soil upon which this crop is intended to be raised, are a sufficient depth and ready penetrability by the plant. A good friable deep turnip loam, and all soils on which potatoes grow to perfection, are perhaps the most eligible of all for growth

of beet roots. A moderate or even large amount of clay, far from being an undesirable element, is very useful in this crop, provided the land is well worked and the clay has become friable by exposure to the air, and by general good management. There is no soil so well suited for beets as a good, well-worked, deeply-cultivated and thoroughly-drained clay loam; or, in other words, a soil containing a good deal of clay, with a fair proportion of sand. Most clay loams contain sufficient lime. On land deficient in lime the sugar-beet is apt to get fingered and toed, and hence care should be taken to ascertain whether the soil set apart for the cultivation of this crop contains a fair proportion of lime. In the north of Germany, beet-growers sow not less than fifteen pounds of seed to the acre; this is about double the quantity of mangold seed usually sown, because beet-roots have to be grown more closely than mangolds. If grown too far apart the roots are larger, but remain poor in sugar. In general the distance between the rows, and from plant to plant, should not be less than twelve nor greater than eighteen inches. Beet roots generally get ripe in about five months. A good indication of maturity is afforded when a root is cut in two with a knife. If the newly cut surface of the beet rapidly turn color on exposure, first red, then brown, and finally dark, the ripening process is not completed; but if they remain unchanged, or turns only slightly reddish, it may be taken for granted that the root is ripe. Great care is necessary in harvesting the crop, for the slightest injury to the roots is sure to be followed by a proportionate loss of sugar. When fermentation sets in, fruit-sugar or glucose is produced, which does not crystallize. The crop should be taken up in dry weather and exposed for a few days to the air, but never to the sun; when stored, especial precautions should be taken to protect the roots from wet and frost.

Sorgo Syrup.

Mr. J. B. Lyman.—I am very glad the subject of additional resources for sugar is before the Club. Disturbances in Cuba, the derangement of the labor system, and want of capital in Louisiana have produced a scarcity of this article, and the likelihood is that all sweetening substances will be much dearer than they now are. It was on this account that I was more ready to accept the commission of the Club to visit Cincinnati and the region adjacent, to learn the present condition of the sorgo interest. I find rather less cane planted this year than formerly, yet the falling off has been slight. More

than usual has been planted in Kentucky; less in Tennessee, on account of the enhanced price of cotton. Sorgo syrup, made in the rude way formerly in use, with no defecation, and boiled in iron kettles, will command thirty-five to forty cents in the Cincinnati market. The general use of Cook's evaporator, by which the superfluous moisture is expelled as rapidly as possible, exposing the juice for a short time only to the action of heat, is a great improvement; and syrup made on this evaporator sells to-day for fifty-five cents in Cincinnati. The raw corn stalk or pumpkin taste of sorgo, which keeps it so far below sugar-house drainings for table use, can be removed partially by lime. But there is danger of producing another and more offensive flavor. Mr. William Clough, of Cincinnati, has invented a method by which all offensive flavor and foreign matters held in partial solution appear to be effectually removed. When the raw juice from the mill has boiled fifteen or twenty minutes, he adds, for seventy gallons, about a quart of silicate of soda and nearly the same quantity of lime and baryta. The silicate permeates the juice, and, in connection with the lime, makes a complete coagulum of all impurities. The only effect of the baryta is to give gravity to the coagulum and throw it to the bottom of the settling tank into which it is drawn. From the settling tank it is dipped or drawn off upon the evaporator and rapidly converted into syrup. When these chemicals are applied as Mr. Clough directs, a superior article is in all cases the result. With the best variety of cans, and on warm, dry soils, a sorgo is made which readily sells for $1.25 per gallon, while, as I said, the best crude sorgo commands but fifty-five cents. I have brought from different sugar-houses a variety of specimens which I would be glad to have a committee take in hand, to report to the Club upon their flavor, color and proximate market value.

The Chairman.—I will appoint Messrs. Whitney, Crandell and Preterre a committee to test these syrups and report upon the Clough process, as Mr. Lyman has seen it in operation.

Planting Orchards.

Mr. O. Snowberger, Quincy, Penn.—Circumstances permitting, I would plant in the fall of the year. There is this important advantage: There will be time for the ground to settle down, and adapt itself to the roots before any hot or dry weather comes. Plant thirty feet each way; less may do in barren regions. In places where trees grow large, thirty-five feet would be all the better. I would buy

budded trees in preference to grafted ones; too much crossing of wood I believe to be injurious. As for pruning, experience teaches me that June is the best time.

How Much Seed-Wheat to the Acre?

Mr. Nathan Shatwell, Concord, Jackson county, Michigan.—In view of the vast amount of wheat that is annually sowed, it is a singular fact that farmers are so diverse in opinion with regard to the amount of seed necessary to be sowed to the acre. In western New York two bushels per acre is considered little enough, while in the same latitude in Michigan and other western States, a bushel to a bushel and a quarter is the more common amount, though some sow one and a half and even two bushels. The three farmers that gained the prizes at the State fair in Michigan, reported in The Detroit Tribune, held at Jackson this fall, for the best five acres of wheat, sowed respectively one and a half, one and a quarter, one and seven-eighths bushels per acres. The amount per acre raised were 34 6-60, 44 17-60, 24 27-60 bushels per acre. Thus one and a quarter bushels of seed raised the largest number of bushels, and the one who sowed one and a half bushels of seed raised more than he who sowed one and seven-eighths. Supposing the land to be the same, the less seed the more wheat; but such, probably, was not the fact. But why do farmers, and the best of farmers too, disagree so widely in regard to the amount of seed necessary per acre? Does not the quality of land, early and late sowing, materially affect the amount of seed necessarily per acre? Does not rich, heavy land, sowed early, need less seed than land of poor quality, or good land sowed late in the season? This, I think, is the fact, and that seed should be regulated somewhat according to the time of sowing, or quality of the land sowed. A bushel and a peck per acre was thought to be sufficient twenty-five years ago in western New York; now two bushels is none too much. If such is correct, farmers sowing after corn, and necessarily late, should be more profuse with their seed. What say the Club? Light on this subject, I think, would be useful.

Mr. J. B. Lyman.—For many years, Mr. Mechi, one of the best farmers in England, has been urging upon farmers the importance of putting in their wheat better, but using less seed. He uses a drill that works exactly, and with it he seeds with a peck to the acre, and gets the best of crops. If a peck to the acre, instead of five or six pecks, will answer, our farmers ought to know it, for the breadstuff thus saved would feed half the poor of Europe.

PLANTING POTATOES.

Mr. A. G. Percy, Newark, Wayne county, N. Y.—I see in one of the reports of the Farmers' Club, a statement by Mr. A. S. Fuller, that, as a general thing, six times as much seed is used as is necessary or desirable. Why, Mr. Chairman, sixteen or eighteen bushels used to be the allowance for an acre of potatoes. Now, I suppose, the Club desire facts instead of opinions, and as I can give them two facts, they may be of value to future potato growers. About ten years ago I planted two rows of forty-eight hills each, of the varieties known as English Whites and Irish Grays, selecting the largest size in one row, and choosing those of the size of a butternut for the other, the culture and strength of the soil as near alike as could be desired. Now for the result: The large ones produced three and one-eighth of a bushel, the small one produced one and seven-eighths of a bushel.

As there is 4,182 hills in an acre, planted three by three and a half feet, the large ones would have produced 273 bushels per acre, and the small ones only 163 bushels, a difference of 110 bushels per acre. Another fact was, that the large seed produced vines from each potato planted, from four to thirty-two that arose from below the surface of the ground, which was a sandy and gravelly loam, whereas the small seed produced from two to eight vines.

2d. This year of grace, 1869, my son planted the Early Rose about the 20th of April, cut in pieces of one and two eyes, and put two pieces in a hill; yield, 100 bushels from seventy rods of ground. At the same time and on the same day I planted the Early Goodrich, by cutting off both the stem and seed ends, and planting the middle of the potato; where long, I cut them in two so as to make the sets of as equal a size as possible, and they produced 170 bushels, on little less than seventy rods of ground. Now, according to Mr. Fuller's opinions, the yield of the Early Rose should have been much the largest, because I planted at least four times as much seed.

That any person can grow more bushels of potatoes from one that is cut fine, and spread over a large space, is readily admitted, but that has nothing to do with the largest yield per acre; and where land is as dear as it is in the vicinity of New York, and other large cities, I am of the opinion that potato growers make a great mistake in using a small quantity of seed, as compared with a more liberal supply.

Sheep Shearing by Machinery.

Messrs. Frank D. Curtis, J. W. Gregory, and A. Preterre, the committee appointed to witness the operation of the sheep-shearing machine exhibited to the Club by P. Anderson, patentee, called the Pneumatic Sheep Shears, would report: That they found at the American Institute Fair another sheep-shearing machine, and invited Mr. William Earl, Jr., the exhibitor, to exhibit it at the same time which he did. Two sheep were sheared by the respective machines at the rooms of the American Institute Fair, on Wednesday, October 20. The machine of Mr. Anderson cuts the wool on the same principle as a mowing machine, being driven by compressed air, conducted to the shears through a rubber tube from the bellows, worked by a crank, and turned by a second person. The machine is very ingenious in its construction, and when sharp will cut the wool closely and rapidly; but it gets dull quickly, owing to the delicate construction of the knives. The power is not sufficient to clear the knives of the wool, the machine presenting the same difficulties in operating that a mowing-machine does in thick, wet grass. Without increased power and ability to keep sharp longer, and not to clog so easily, the committee could not commend this machine, but yet it has some decided merits, which are the closeness and evenness with which it shears. The machine of Mr. Earl shears with a rotary-knife with two cutting points, rotating on a bed plate with notches or guards which rest on the body of the sheep, and is attached to a universal joint, connected with a revolving rod to a wheel, turned by a belt driven by a crank and wheel turned by a second person. The machine is easily adjusted, and the universal joints will turn in any direction, allowing the shearer to work the knives without the least difficulty on any part of the sheep. The committee are of the opinion that in the hands of an experienced operator the machine will do good work.

Mr. J. W. Gregory.—Although I sign the report, I must say that the closeness with which it shears is to some extent an objection. With the delicate, fine wooled stock, I cannot but think that it leaves the animal with too scant covering. If I had a sheep worth several hundred dollars I should prefer the old practice in the shearing.

The Wickedness and Folly of Bird Shooting.

Dr. Trimble, the well known entomologist of New Jersey, displayed the carcases of a great number of forest warblers which had

been killed by cruel sportsmen and exposed for sale in Washington market, and spoke as follows: Any one who wishes to learn the condition of the fruit crops of the country can have no better place than Washington market of New York. Quinces, the late pears, and the winter supply of apples are now there. Those whose eyes have been educated to see blemishes upon fruit will be astonished at finding so many. The most apparent are those in the apples, and caused by the apple moth. This insect is second in importance of all the enemies of our fruits. This moth, like most other moths and butterflies, increases rapidly. Some deposit several hundred eggs at a brood, and there are two broods of the apple moth each year. The rules of arithmetic would show us how such a rate of increase would so multiply all these enemies that all the apples of the country would soon be appropriated by them, none left for us. But this insect, like most others, has its checks. The weather sometimes comes to our relief. Some insects feed upon other insects, and many are destroyed by parasites. But I wish to speak now particularly of birds as our friends in protecting us to a great extent against the dangerous accumulation of insect enemies. Here is a bunch of a dozen birds, already picked, bought in Washington market. Two of them are the downy woodpecker. This is one of the woodpecker family that remains with us all winter, and, like most of the others, is exclusively insectivorous. Here are some specimens of apples, like millions and millions of others every year, perforated through and through by an insect, until it is out of shape, insipid, and almost worthless. This is the work of the caterpillar of an apple moth. This caterpillar, after feeding to maturity, leaves the apple and seeks a place of concealment in which to spin its cocoon. If the tree has scales of bark large enough to suit its purpose it will take refuge there, and there this downy woodpecker finds it. Here are scales of bark from apple and pear trees, under which the remains of the cocoons of this insect may be seen, and on the other side of each you may observe a hole leading directly to the middle of that cocoon. That hole was made by one of these downy woodpeckers, and through it he has taken the caterpillar that had destroyed an apple. I have long known that this terrible enemy of our fruits had its enemy among the birds, but until I found in the stomach of one of these downy woodpeckers several of these caterpillars, I was at loss to know to which of the many birds we were so much indebted. After long and painful watching I was able to identify this one,

caught in the act, and there is probably nothing more wonderful in nature than the ingenuity of many birds in finding their insect prey. This one finds this concealed caterpillar not by seeing it, that is impossible; not by smell nor by motion, it is as quiet as a mummy; neither by instinct; the bird is American, the insect a foreign importation; no, he finds it by sounding; he taps all scales alike, but stops to make a hole through the one under which the worm lies. Could we have this bird in abundance, we should have more and better apples and pears, but, like all the other woodpeckers, it is diminishing in numbers, in proportion as the woods of the country are cut away. And, sad to tell, the few that are left of this most valuable of all our small birds, are sold in the markets of this city, ready picked, for four cents a piece. Here are the heads of five cedar birds, sometimes called cherry birds, in consequence of the bad name this bird has from the circumstance that it will sometimes take cherries. I have given it a thorough investigation. I have killed many; more than I ever will again. In the stomach of one I found several canker-worms, so perfect as to be readily identified, and the heads of enough more to make thirty-six in all. Think of that! One cedar bird taking at a single meal thirty-six canker-worms. This insect has for half a century been a perfect scourge of the apple orchards of a great part of New England, and has at times seriously threatened other sections of the country. This little bird is a gross feeder, and continues in flocks till near midsummer. Where insects appear in great numbers, as the canker, and other span-worms sometimes do, it will come suddenly in large flocks, and feed there day after day till the pest is subdued. And this beautiful little friend of ours, the second best of all the birds, is sold by bushels in this market both fall and spring, and no one, not even Bergh, to cry shame. In the stomachs of these cedar birds I found nothing but cedar and juniper berries, the peculiar smell of the latter was very perceptible in the stomachs of two. The lovers of gin will probably be the enemies of this bird in future, but, when it is known that all the juniper berries used in this country come from Europe, it may modify the wrath of the gin drinkers. Here is the head of the American shrike, or butcher bird. Its stomach was filled to repletion with a mass of insects. but so comminuted as to be undistinguishable except by a microscope. This bird, it is said, will transfix insects on thorns or briars, after satisfying his present wants, so as to keep them till hungry, Here is a meadow lark. You will observe how long and strong the

the beak is. He had fed to repletion on a species of redivious insect, like the squash or pumpkin bug. In all examinations of the stomachs of larks, I have found insects only, and nearly always but one kind of an insect at a time. In the early spring they will feed upon iules, a species of centipede, found about the roots of grapes. In the summer you will find beetles. This bird appears to have an instinct by which it knows where to find its insect food by the appearance of the vegetation, and its beak is formed for such a purpose. If shot when feeding it will be found coated with mud. This bird is found insectivorous, except when the ground is covered with snow; it will then, from necessity, visit your barns or stacks for seeds and grain. And now, please, let your imaginations carry you back to the country in June, on the old farm near the meadows. You see these superb tints glistening in the sunbeams. You hear that glorious burst of melody, and the sense of happiness thrills all through you. God knew how to make a world and to call it good when it was made. He made the meadow lark. He painted it. He made its beak to penetrate the earth, there to catch the insects sapping the roots of our plants. He fashioned the organs to produce that wonderful melody. Meadow lark are sold in your markets for ten cents a piece. Here is a robin; bushels and bushels of robins are in your market for one dollar a dozen. How would any of you feel if some vagabond boy should shoot your robin, the red breast that greets you morning and evening from the top of your highest tree in the garden? This larger bird is the largest of the woodpecker family in this part of the country. It is commonly called a flicker, sometimes high-holder, because it makes a hole for its nest high up in a tree. The stomach of the bird contained a red berry, like a cranberry, the seeds of dogwood berries, and nearly a thousand small ants. From former examinations of this bird, I should judge that ants are its chief food. I once counted 800, mostly in the larvæ condition, taken at one meal. The flesh of the bird is hard and the smell rank, not fit for food, still it is often in the market. Here are the heads of three cat birds. Every one knows this bird. It is everywhere in the country, and often frequents our larger gardens in the city. It is a mocking bird, and very nearly allied to the one kept as a pet. Like your pet mocking bird, it will eat a great variety of food; these had been feeding upon berries, one had eaten purple ones from a species of dogwood, until the stomach was purple through and through. In summer, when feeding its young, the cat

bird is often very valuable. Many times our grape leaves are destroyed by caterpillars; one species this last season was very destructive, they appearing in great numbers very suddenly, and from their manner of feeding are called processionary caterpillars; in a few days the leaves on those grape vines will be mere skeletons. If cat birds have nests in that neighborhood, those processions are soon broken up. Near where I bought these birds was another stand kept by a woman, where birds still less were hanging up for sale. I asked her what they were? She said, reed birds (reed birds left us for the south a month ago). She had ten or twelve bunches, with a dozen on each. They were blue birds, yellow birds or finches, creepers, nut hatches, several downy woodpeckers, but the greater number were wood robins and the hermit thrush, and at four shillings a dozen. I offered to buy a dozen if she would let me pick out the different kinds. This seemed to excite suspicion, and she at once said: "There were no English sparrows among them." I soon found that it would be impossible for me to get what I wanted, and left, intending to send some one the next morning to get either an assortment or take the whole. But the next morning they were gone. The blue bird I had several times examined, finding it exclusively insectivorous, as its beak indicates. The creepers and nut hatches can eat nothing else but insects. The wood robins and hermit thrushes I have never killed, nor never will. While the beaks indicate them to be somewhat omnivorous, like the other thrushes, as they live almost exclusively in the dense woods, they can do us no harm, even if they do not live exclusively on insects. Any one familiar with the song of the wood robin, needs no description. That most valuable author on ornithology, Alexander Wilson, left directions in his will that he should be buried under the trees in the burial ground of the Swedes' church, near Philadelphia, so that the birds could sing over his grave. Of all the singing birds, the wood robin was the special favorite of Wilson; but the song of the hermit thrush was considered by Audubon as still more exquisite. By common consent the melody of these two little birds is unrivaled in this world, and yet a woman in Washington market calls them reed birds, and sells them for four shillings a dozen. I have for years been investigating the food of birds. I wished to know positively how far they were useful to us in controlling the insects destructive to our crops. I have killed and dissected many, so that the information should be absolute. I shall kill no more for such a purpose. I have learned enough to satisfy any one

that the birds are one of the links in the chain of creation, just as necessary as any other link, for the harmonious work of the whole. There is a check and counter-check everywhere. Take out the birds, and insects would preponderate. Hundreds of instances could be given where the experiment has been tried. Now, what can be done to prevent the wanton destruction of agents so valuable? In New Jersey we have a law ample for the protection of the birds, if enforced. Most other States, I believe, have similar laws. But your markets show how little they are regarded. This Club may do something. By giving proper information we may show the people how much it is to their interest to spare the birds, and thus create a public sentiment stronger than law for their protection. True, some of them will help themselves to our cherries, and an oriole will occasionally sip nectar from our grapes. Not only boys, but even men, have been known to shoot them for making so free. Let me implore both men and boys to shoot no more birds from such a motive. Remember they work for you seven days in the week, and charge you nothing but this occasional indulgence.

CLUB-FOOTED CABBAGES.

Mr. C. A. Dunning, of Denton, Md.—I see that Mr. P. T. Quinn is troubled with "club root" in his cabbage, and tempts with lucre any "man, woman or child," who will tell him how to prevent it. Now I will give him a sure remedy, and accept his $100 (with a copy of his "Pear Culture for Profit," as part payment). If he will give his ground fifty bushels of shell lime per acre, every five or six years, or whenever his cabbage begins to "club," he will have no trouble with it, and can raise it on the same ground two or twenty years in succession, if he wishes to. I have cabbage this year on ground that has been in cabbage *thirty* years in succession, and it has been limed but *once* in that time, but begins to need it again. He should apply the lime this fall or winter, after he takes his crops off, and next spring prepare his ground as he has always done. If next summer he is troubled with club root, I have wasted my stamp; if he is not, I will accept *his* stamps.

Mrs. Jerusha Sutton, Ottawa, Putnam county Ohio.—I accept Mr. Quinn's proposition, and give the following *modus operandi:* Prepare the ground in the fall with a light coat of well rotted barn manure, and a coat of well leached wood ashes (say one inch thick); spade deep in the spring, then set the plants, and then give the land

a light sprinkling of salt; stir the ground often; by following this method I have raised good and large cabbage twelve years in succession on the same land. The soil should be clay, loam and sand, of equal parts.

Mr. P. T. Quinn.—There must be something in the lime prescription. I have myself received fifteen letters, twelve of which advised lime, the remainder salt. I have frequently tried both, and without effect. Still, I shall next year make further test of all directions that may be sent, and will gladly award the prize to whosoever it may belong.

Mr. A. S. Fuller.—I tried lime in Brooklyn, putting it in the seed-bed very thick, but club root came all the same.

The Eumelan Grape

Was shown by Messrs. Hasbrouck & Bushnell, of "Iona," near Peekskill, N. Y., including specimens of each quality, extra numbers one, two and three, which were afterward distributed to members of the Club. The extra one year old vines were such as are seldom grown, but a member of the Club who has visited Iona Island, where they were grown, claims to have seen several thousand there of equally good quality. Even the number three in quality were much better than we have often seen sold of other sorts for number one.

Mr. A. S. Fuller said, he had seen and tasted the fruit of the Eumelan in previous seasons, and had formed a very high opinion of its quality. The first he saw this year was at a meeting of this Club early in September, and it was the first ripe grape shown here this season. At Philadelphia he saw some good bunches of it which were shown at the exhibition of the American Pomological Society, and had heard the quality of the fruit highly praised by all who have tasted it.

Mr. J. B. Lyman.—I feel it the duty of this Club, when a new fruit is introduced which gives promise of so general success as the Eumelan grape, and there are those among us who know its value, to give full reports for the benefit of thousands who look to our printed reports for the information they so much want, and which will be of great benefit to them. I for one highly commend those who have risked much in the dissemination and general trial of the Eumelan, and congratulate them upon the success that has crowned their efforts. A grape of ordinary quality that will succeed everywhere, like the Concord, is a national blessing, and much more so the Eumelan, which promises to be equally adapted to general culture, and is of the highest quality.

Adjourned.

November 9, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

FRUIT TREES AND FIELD MICE.

Mr. David Whyborn, of Mexico, Oswego county, N. Y., gave the following as his method of protection during the snows of winter: One way is to draw up and place around the body of each tree a small mound of earth, say from ten to twelve inches high. Another: Cut open old stove pipes and place around the trunk. Either of the above (whichever has been the most convenient), he has practiced with success for the past twenty years.

Mr. Solon Robinson.—Tarred paper, which costs something like four cents a pound, is cheaper, more easily applied and equally efficient.

Mr. Frank Curtis.—A still easier, better and less expensive practice, is to place three or four shovels full of well-rotted barn yard manure at the base of each tree, pressing it closely. In spring spread it about the surface. This is sure, and enriches the ground withal.

Mr. John Hague, Clinton, Iowa, has, he says, found his way effectual in an experience of over twenty years: Get equal parts or quantities of common black soot and sulphur, mix them well together in a dry state, and then make some weak flour paste and mix in it the sulphur and soot to the consistency of paint just ready for the brush; lay this on to the trees and vines just before the hard season comes on, and don't be afraid to lay plenty on, even up to the branches, and if another coat was put on in spring, right up into the branches, we should not hear much about bark lice and other things. This compost has this to recommend it; the rains wash it off in spring, and it makes a good liquid manure to give the vine or tree a start with, and if the sun hatches out any insect eggs near it, the grubs or larvæ don't like the fumes of the soot and sulphur, and they leave for quarters not quite so strong. It don't kill them, but insects are like human beings, they like easy places to live in, or on, and move if they are annoyed, often to be destroyed by other casualties.

THE BARBERRY BUSH FOR HEDGES.

Mr. John B. Woods, of Great Falls, N. H., wrote as follows: Several years ago I called the attention of the Club to the policy of using barberry for hedging purposes. In a moist soil it will grow eight

feet high, and the tops bend over so as to make a beautiful appearance. It is prickly, and will make a good protection for orchards and fruit gardens, as the wicked boys could not climb over it, and should they attempt to go through, they would get more scratches than they bargained for. It need not be guarded from cattle, as they do not care for it as an article of diet. Suppose a man wishes to divide his pasture, let him plow one furrow and sow in it three rows of barberries about three inches apart. This will take from three to six to a lineal foot, and one bushel, which in this vicinity will cost one dollar, will be sufficient for thirty rods of hedge. As the berries usually contain two seeds, I suppose that, planted as above, the hedge would be sufficiently dense; but if not so, let it be cut down when two or three years old, and then the roots will send up shoots, and in this way the hedge may be made as wide and thick as desired. There is no danger of its spreading from the roots unless the tops are cut. There is a bush in this town which I set twenty years ago, and it has not spread an inch. As the cattle would root out some of the plants, let the man sow a nursery of the berries, and when the hedge is sufficiently grown, then fill in the vacancies from the nursery, taking care to protect the newly set bushes till they are well rooted. In this way a farmer can obtain a cheap fence, which will last forever, for I know of no way to kill the barberry bush but to dig up its roots.

Mr. A. S. Fuller.—I said ten years ago that barberry is the best hedge plant in America. It is better, however, to sow in nursery and transplant, than to sow in the hedge direct. As to the old prejudice against it that it blasts wheat, I don't believe it altogether. Yet it is true that a fungus on the bush resembles the fungus on wheat, and some seasons one may become the other.

How to Have Dry Cellars.

Mr. S. Herrick, Oberlin, Ohio, having observed the consideration given to this subject in the Club, gave an account of how he managed: I made a cellar during the past season, which answers a good purpose. I did not excavate at all, simply leveled the ground. To prevent dampness, mildew, &c., a few inches above the external grading I left an opening in the wall four by eight inches, which is covered with wire-cloth. From the wall overhead I extended a ventilating tube of the same size some ten feet to the ridge of the house. Except in very cold weather the ventilators are open, which gives a constant current of air through the cellar. This contrivance is very

little expense, and removes all superfluous dampness and bad air so common in cellars. The plaster of the bottom did not set well, and after several days the mason told me that I would be under the necessity of getting some fresh lime and plastering it over again. I concluded first to try the expedient I have seen recommended in the Club. Accordingly I took a plank and beetle and pounded it severely all over the bottom. I then smoothed it with a trowel, applying all my strength, which made it quite smooth, and it soon became very hard.

Mr. H. B. Smith.—If a layer of asphaltum be placed between two layers of cement there will be no trouble. This plan is practiced extensively in this city. I tried it myself in Canal street, and had a cellar perfectly dry.

Mr. W. M. Doty.—A drain six inches below the cellar bottom has been found effectual. Of course this is not admissible when the excavation is lower than tide water.

Mr. Solon Robinson.—A coating of plastic slate over a thoroughly cemented wall will have the desired effect.

FOREST TREES.

Mr. E. P. Deihl, Olathe, Kansas, would like to know the best varieties for his prairie country.

Mr. A. S. Fuller.—White ash, hickory, black walnut and sugar maple. The last named is a more rapid grower than the others. In 1860 I set, in Brooklyn, some sugar maples, and they are now eight inches in diameter. Since then nearly 40,000 have been planted in the same city. The ailanthus is an excellent timber tree, almost equal to the locust. It is a rapid grower and makes wood which is particularly fine for cabinet work.

Mr. Solon Robinson.—I am glad to see this subject considered. We must wake up to the necessity of restoring our forests, else we will find, not long hence, our country as barren as the wastes of Africa.

Mr. Wm. Lawton.—The sugar maples deserve all the praise that can be given them. Beside their practical advantage for timber, they are beautiful for shade, and, at this season of the year especially, beautiful to view.

GRAFTING GRAPE VINES.

Mr. R. C. Meeker, Collamer, Ohio, wrote as follows: For the last two years in this section (eight miles east from Cleveland), Catawba

grapes have been unable to get ripe previous to severe frosts. Many vineyards are now unpicked, with much of the fruit soured and injured, which otherwise would have been good. The seasons thus placing this grape in such narrow limits for maturing, the question has arisen whether bearing vineyards five and six years old or more, can be grafted successfully with earlier kinds, say the Delaware. It is understood that the vine can be grafted. But is it practicable to graft acres, and would the grafted flourish as well as the natural vine?

Mr. R. H. Holton.—He had better rid his ground of what cumbers it, and plant new vines. Old vines can be grafted, but not with such success as would warrant the adoption of the plan on an extended scale.

Asparagus.

Mrs. E. Harrington, Claytonville, Kansas.—I wish to know how to raise asparagus, how to prepare the ground, when to sow the seed, and how it should be cultivated. Please lay the matter before the Club.

Mr. P. T. Quinn.—Sow the seed next spring, in well prepared ground, in shallow drills, covering the seed with half an inch of earth. During the summer select a piece of ground the size required, and thoroughly pulverizing it to a depth of twenty inches, add plenty of manure, the more the better for asparagus. In the following October, if the plants were taken good care of, they will be large enough to transplant in the permanent bed. For garden culture, make the rows a foot apart, and set the plants three or four inches deep and twelve inches apart in the row. In field culture, the rows should be two feet apart.

A Show of Fruit.

The table was spread with specimens of apples, pears, and grapes, the latter of the Iona and Diana varieties, and brought by Mr. C. W. Idell, the well known commission dealer. He remarked that he offered them to show their appearance when kept until this late day. The Ionas were grown in Schuyler county, and some in the Pleasant Valley district. Indications, the present season, have gone to show that the variety is not popular. There has been scarcely any demand for it in the market, and sales have been effected with much difficulty. Last year there was more call for Ionas, but the supply was limited. The same is true of the Dianas. The Catawba is an excellent grape,

but there seems to be more money in the Concord, and this season it has stood number one in point of popularity.

Mr. Wm. Lawton spoke of the fine exhibition made by Mr. Idell, and moved that the thanks of the Club be awarded to him.

Mr. P. T. Quinn showed some pears resembling both apples and quinces; he called them the Japan pears, and said that the tree makes enormous growth, holds its foliage, and will prove ornamental if not useful. It is also very productive, a single graft set one year ago having produced this season fifty-two perfect specimens of fruit. For table use this fruit is inferior, but better for cooking purposes, and likely to be worth eight to ten dollars per barrel. Mr. Quinn desired to be understood that he has neither trees or scions to sell, nor does he know where they may be procured. He also showed the Buerre d'Anjou, which, he said, stands at this season as the Bartlett in its season. The trees of this variety do not bear very well at the outset, but are good producers when further advanced.

Mr. Wm. Lawton exhibited a Newtown pippin, an apple which cannot be grown in this section of the country, in consequence of its cracking propensity, but which has never been surpassed in the public favor.

Mr. T. D. Curtis showed snow apples, which variety is peculiarly productive in cold climates. Carefully picked, it will keep far into January. Canadians grow eloquent over its excellencies.

STATE FAIR IN GEORGIA.

Dr. Trimble moved that a committee of three be appointed to represent the Farmer's Club of the American Institute, at the State Fair of Georgia, to be held at Macon on the 11th inst. Carried.

The following committee was appointed: Dr. Issac P. Trimble, Mr. Solon Robinson, Mr. N. N. Halsted.

WASH FOR APPLE TREES.

Mr. W. P. Gates, Windham, Conn.—Will you allow me to ask two or three questions, more or less? Prof. Mapes recommended sal. soda as a wash for apple trees. Why is it preferable to potash for the same purpose? Will an application of gypsum, say two bushels per acre annually, supply sufficient lime for an orchard just beginning to bear, the land being a potash soil? Would an application of salt, about three bushels to the acre, be a benefit sufficient to pay the expense? I manage my canker worms in this way: Take a band of rye straw,

bind it around the tree, say three feet from the ground; then, when the moth begins to ascend, apply coal tar on the straw and on the body of the tree, say four inches wide; saturate the straw well with the tar, and it does not become hard as soon as common tar, and an application three times in a week is sufficient. If the Club can answer the above questions at their next sitting they will oblige.

Mr. P. T. Quinn.—Four pounds of potash dissolved in one gallon of water, will answer the same purpose. Two or three bushels will be enough. An application of eight bushels of salt, instead of three, will be found beneficial to any crop, and will increase the product more than twice what refuse salt should cost.

Adjourned.

November 16, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Seedless Apples.

Mr. Lysander Barrett, of French Creek, West Virginia, forwarded a half bushel of this remarkable fruit, and wrote as follows: I trust the Club people will no longer doubt my former communication on the subject. The origin, as I learn it from the owner, is something like this: Eighteen years since he sent to a fruit grower in Monongahela county for some grafts of his choicest apples, and among them was the kind before spoken of. He further informed me that the seedless apple trees have never failed to bear fruit every season since the first commencement of their bearing up to the present season, while the ordinary kinds of fruit around it were all killed by the frost in the spring. I was informed that they are a good apple for cooking purposes, and will keep until the month of February. Those sent you were gathered on the 26th of October, were exposed to all the hard frosts since, and these have made them considerably tougher and improved the flavor. They are considered a good apple to cultivate for drying, being much heavier than other apples, and no waste in coreing, &c.

Mr. Horace Greeley.—Allow me a word. At least fifty years ago I saw it stated that if a limb of an apple tree be stuck in moist ground bottom end up, it would take root and grow, and produce the sort of fruit which our friend describes. I don't believe the story was made entirely out of whole cloth, still gentlemen may have some

cause to sneer. Now I say that if there is a mode of producing apples of the kind described it is a very great advantage. It is an important circumstance that this bears uniformly when others do not. I certainly should like to have our ordinary varieties manifest these characteristics. I apprehend that when our friend says no blossoms, he means that the blossoms are, as compared with those of other trees, very small and peculiar. Unless gentlemen can argue the seal off the bond, the fact is established in my mind that apples will grow without seeds.

Mr. A. S. Fuller.—I hope some of these specimens will be forwarded to Charles Downing, and I have no doubt the next spring he will take the trouble to go and see the tree. I have heard of seedless apples being produced in the way explained by Mr. Greeley. I am satisfied that these apples are seedless, though there may have been in the tree some freak of nature which we do not understand. I don't see the necessity, according to vegetable physiology, that fruit should have flowers, but there certainly is necessity of producing seed to propagate the species.

Mr. J. W. Gregory.—The disposition of all plants prepared and continued by roots, cuttings, eyes, grafting and budding seem to have to tend toward becoming seedless, or impotent to reproduce by blossom and seed-bearing, as by a course of habit. Take for instance the common potato, dahlia, ramie (Boehmeria Tennacissima), and southern sugar cane. These have mostly reached a sterile condition, perhaps chiefly from this habit of continuing; "like" in this does not exactly beget like, but has a general if not an exact resemblance to the parent, whereas, from seed, the fruits generally widely differ, and except when hybrids, and care is used a small per centage only is equal to the parent.

Mr. P. T. Quinn.—If the law of which Mr. Greeley speaks produces apples without seeds it does not operate with other fruits. For instance, I inverted some current cuttings and no change was noted in the returns.

Mr. Horace Greeley.—I do not say or think it may be so in all cases, but I do say and think that if what our friend writes be true, it is of great importance to find out how we can make the principle generally apply. My apples are generally, a good part of them at least, destroyed in the blossom. I hope some investigations will be made.

The Chairman.—I consider the subject of sufficient importance for

a committee to whom the subject shall be referred with instructions to report in regard to all the peculiarities and collateral facts. For this work I will name Messrs. Fuller, Downing, Lyman, Quinn and Crandell.

Vegetable Seeds.

Mr. J. H. Lee, American Ranch, Prescott, Arizona Territory, wrote as follows: Inclosed the secretary will please find ten dollars, which he will confer a great favor to me by handing to some practical farmer, and in return request him to send me several four pound packages of winter wheat, with full instructions as to sowing, &c. Our winters here are very mild, scarcely any snow or frost sufficient to stay frozen all day, but owing to the altitude we are liable to late frosts in June, which might prove fatal to wheat. I would like, also, to correspond with several members of the Club for the purpose of exchanging wild seeds of various kinds, which abound here, for vegetable and garden seeds of different kinds. Last spring I paid ten dollars a pound for all my garden seeds, in fact all kinds of vegetable seeds. I planted carefully according to directions, and when they came up some were one thing and some another. Will the Club refer me to some reliable person to procure seeds for next season, as our mails out here, owing to Indian difficulties, are very uncertain? By commencing now I might procure a good supply by next planting.

Mr. J. B. Lyman.—I don't know a better wheat grower than Geo. Geddes of Syracuse. I propose that half the money be forwarded to him, with a request that he oblige our correspondent in the way indicated. The other five dollars might be put into the hands of some reliable seedman.

Ramie.

Mr. D. B. Ranney of Smithville, N. Y., asked several questions on the subject, to which Mr. J. G. Gregory, a gentleman who may be considered authority in the matter, made the following replies: 1. A wet soil is not necessary, neither is irrigation essential. 2. The climate of Middle Georgia is not favorable to its growth. 3. There is no good machine yet in operation for reducing the cuttings to marketable condition, but I was recently informed that Mr. Erastus Bigelow, President of the National Wool-growers' Association, has a machine which he thinks will do the work well. I shall have opportunity to investigate further, and will report hereafter.

The Castor Bean.

Mr. D. B. Ranney also desires information of this tropical plant. How is the oil extracted; what machinery is required, its cost; also, an estimate of the profits reasonably to be expected from an acre? Mr. J. W. Gregory replied: In Illinois the crop which some years ago reached up to twenty bushels or more per acre has fallen off to eight and ten, and still is raised, probably being preferred on account of requiring less labor than almost any other crop. In Texas, Judge Bellinger informed me he had raised 100 bushels, and though this is an extraordinary case, yet I presume when it has been well attended fifty bushels per acre has resulted. This has brought about $1.75, coin, per bushel of forty-six pounds, and of course shows the great adaptation of both soil and climate of Texas to its successful growth. It commences ripening about June 20, and continues until the end of November.

Allies of the Agriculturists.

Dr. J. V. C. Smith.—I am not going to inflict you with a speech, but rise merely to make reference to one of the birds shown here a fortnight ago by our kind-hearted friend, Dr. Trimble, namely, the read-headed wood-pecker. I made a dissection, and found it one of the most curious and interesting subjects I have had under my scalpel for many a day. I wanted to find out how these creatures give the trip-hammer motion to the head. Dr. Smith then proceeded to explain by means of drawings, and went on to say that the bird ascertains the position of its victim in the tree by means of exceedingly acute sense of hearing. I do not think, he continued, that they ever make a mistake, though they may be frightened away and thus leave the work, in some instances, incomplete. The tongue is exceeding long, and the insect is pierced and drawn out of its resting place. In conclusion the speaker said: You may depend upon it the red-headed wood-peckers are the friends of the farmers, and, as Dr. Trimble urged, they ought not to be destroyed. There is no excuse; even sick people had better have mutton broth. To shoot these scavengers is nothing but cruelty and hard-heartedness on the part of those who roam over the country with guns, and call it sport.

The Chairman.—We are certainly under renewed obligations to Dr. Smith. I have thought that one of the most important papers ever presented here was his plea for toads. I put the suggestion into practice, and since then have been frequently laughed at by my

neighbors for paying a dollar a hundred for these unattractive creatures, which I keep on my grounds by the thousand, to guard the growing things when I sleep.

Large Crops of Corn.

Mr. J. William Cox of Hamerton, Pa., forwarded several very large ears of corn, twenty-two rows to the ear. In fact, the maize was quite amazing, and he wrote of it as follows: The ground upon which it grew was prepared by spreading twelve loads of barnyard manure per acre on the soil, which was plowed down in the spring to the depth of six or eight inches. The corn was planted in drills four feet apart, by eighteen inches in the drill. One hundred and fifty pounds of phosphate was *drilled in* with the corn. The yield will be from sixty-five to seventy-five bushels of shelled corn per acre in six acres.

Mr. C. M. Hayes, Horlleton, Union county, Pa.—I will give you a brief account of a corn crop that I think is hard to beat. We plowed three acres of timothy and clover sod late last fall, about three-fourths of an acre of it being a "made soil," having received the wash of a considerable extent of country for a good many years. Of this rich land we measured off two half acres, one of which yielded 107 bushels and a peck of corn in the ear; the other eighty-one and a half bushels. Variety was what is called here gourd seed. We marked out both ways, and then had hard work to keep down the weeds. Cultivated it seven times; about one-fourth of an acre was planted in potatoes, the remaining two and three-fourths acres yielded 395¼ bushels of corn in the ear. We seldom have had better crops throughout this valley; hay, wheat, oats, corn and potatoes, all are more than usually abundant.

Report on Sorghum Syrups.

Messrs. Curtis, Gregory and Preterre, to whom the sorghum syrup was referred for test, reported as follows: We went to the rooms of Dr. Preterre and first subjected the different specimens to the most discriminating judgment we could make by the palate. The bottles of crude sorgo we found of good color, especially that made on Cook's evaporator, but the taste was objectionable on account of the strong flavor of corn stalk or raw pumpkin, which, notwithstanding its fair color, so depreciates its value that the committee is not surprised to know that it sells in the Cincinnati market at fifty-five cents a gallon. The bottles numbered two and three, syrup made at the sugar-house

of Col. Branch, near Cincinnati, was of dark color on account of the lime used, but in purity of flavor we mark it seven on a scale of ten. A certain twang and acidity by the litmus test are explained by the circumstance that old sour molasses was mixed with the raw juice in making this syrup. The bottle marked four, made at the example farm of the Kentucky University at Ashland, we found a very superior article. Obtaining some Stewart's sugar-house syrup that sells at $1.25 per gallon, we pronounced the Kentucky syrup equal to it in every respect. This syrup was made by the Clough process—the juice of the cane first defecated by silicate of soda, sweetened with lime and thrown to the bottom of a settling tank with sulphate of baryta. From evidences brought before us we regard the practical effect of Mr. Clough's discovery as of great importance, as it enables the sorgo growers to make a syrup twice as good and commanding twice as much in market as that made by common, rude methods.

Sick Horses.

A correspondent writes from California: About a year ago I traded for a horse that looked as if he had taken cold, discharging at nose and eyes. We turned him out with the other horses that were feeding at a strawstack. We soon noticed symptoms of it in them also; in fact, they were all more or less affected. We examined closer and found that those who have taken it, the worse are swelled in the glands of the throat, generally on one side, discharging at the nose and eyes; a slight cough also. It is certainly very contagious. The animal shows it worst when heated up. Is it the glanders? We have had one horse that has had it six months, and when staked out on green grass all the time, he is in first rate condition in every other way.

Mr. A. B. Crandell.—I submitted this letter to Prof. Lorge of the veterinary college of this city, and he kindly forwarded the following reply: "From some of the symptoms noted, glanders would seem to be the disease. The writer does not state if there are any ulcers in the nostrils, as is most likely the case if the disease is glanders; neither does he say whether there are any sores on the legs or body, as would be the case if the disease is complicated with the other form of the same disease known as farey. He alludes to a discharge from the eyes; this is *not* a prominent symptom in sub-acute form of the disease. There is a disease known as Ozena, or chronic nasal gleet (chronic catarrh), that in appearance similates very closely to gland-

ers, but is not contagious. With regard to a remedy, if the disease is glanders, it is incurable. The animal or animals had better be destroyed to prevent further contagion; besides it is communicable to the human subject, and is a deadly disease to the latter; therefore, the greater care is required by them in handling glandered horses. If the cases are Ozena, a long course of tonic treatment with astringent washes to the part, nourishing food and cleanliness are advised; but I think from description the disease is glanders."

Mr. J. Morman, Dakota City, Nebraska, describes a disease among the horses in his vicinity. He says they eat well, but are poor and run at the nose, and have small ulcers in their nostrils.

Mr. F. D. Curtis.—The disease is undoubtedly feru, and the sore nostrils and running at the nose the effects of it. Give laxative food; steam the nostrils, and swab them out with honey and borax. To steam the nostrils, envelop the head in a covering of cloth, and connect the same with a pail, in which put a handful of hay, and then pour on scalding water. After treatment, keep the animal warm.

Forest Trees.

Mr. J. Delano, Fair Haven, Mass., made certain inquiries, which were answered as follows:

Mr. J. B. Lyman.—This farmer asks how much an acre of woodland is worth a year, about one-fourth pine and three-fourths oak, three miles from market. He may calculate that it will take, on an average, thirty years to grow fifty cords of wood on an acre, and so base his estimates, considering this a liberal calculation, for on many surfaces a cord a year is all that can be expected. But if some of the trees are large and straight they attain a value for manufacturing uses far beyond the figures for cord wood. I am glad the farmers on poor soils in New England have begun to calculate on wood as a crop. One-third of the open land of those States ought to go back to forest. If there had been any facilities, or safety in traveling west, or if our fathers had known of the great superiority of western soils, they would never have cleared the original hemlocks and beeches from those rocky hills. It was a mistake made in their ignorance of the immense agricultural capacities of this continent; and now that all regions are open, it is well to let those granite soils yield the vigorous forest growth of which they are so capable, and by which they will yield a better return than from any cultivated crop.

Mr. William Lawton.—William Penn, a thoughtful and good man

who did little that merited reproach and much that deserved high praise, designed that six per cent of all the lands sold by him should be kept in wood. In fact, the title was made dependent upon this point, and it is unfortunate that it should not have been observed to this day. And there was De Witt Clinton, the father of the Erie canal; I remembered that he wished fully one-third of the land retained always in forest, not only for purposes of fuel but for the effect upon vegetation.

PEAR CULTURE.

Mr. Jay, of Camden, contemplates planting an orchard of standards, and anxious to be right, comes to the Club with the following questions: Is there not a probability that the extension of railroads through various parts of the country, the much better supply of the market in future, and the superseding of present varieties by others, will render an orchard planted now less profitable than those at present in bearing? And, in regard to certain improved kinds, is not the liability of much of the fruit being shaken from the tree, when a grown standard, by winds an objection? Lastly, what varieties would be best for the middle section of Delaware?

Mr. P. T. Quinn.—In the culture of pears for market purposes, we can only judge of the future by referring to the experience of the past. For twenty years the demand and prices of well grown pears have steadily advanced; the demand is always in advance of the supply, although it would be a safe estimate to make, that there are now in full bearing twenty pear trees, where twenty years ago, there were not more than one. I apprehend no difficulty from new varieties superseding those that are now popular. There have been large sums of money foolishly spent, and many persons discouraged in pear culture, by making or planting numerous varieties unsuited to the soil or climate. The person who will commit this folly now is certainly not wide awake to his own interest. When standard pears are trained on pyramids, the danger of fruit being blown off and injured is very trifling. The following list of varieties, planted as standards, except the Duchess d'Angouleme, will do well in Delaware, Bartlett, Beurre Bosc, Duchess d'Angouleme, Lawrence and Beurre d'Anjou.

FISH CULTURE.

Mr. E. Sterling, Cleveland, Ohio.—My knowledge of this business has extended over a period of twenty years, and have every reason to

believe that I am somewhat acquainted in the matter. Your correspondent does not say the amount of water his spring yields, or its temperature. Now, these are important items, especially if you expect to raise trout. Your ponds must vary in size, according to the supply of water; and for raising brook trout, the mean annual temperature must not be above fifty degrees Fahrenheit. They will live in warmer waters, say sixty-five degrees, but you cannot propagate and raise healthy fish in such water. However, with the spring as you describe it, you can raise *black bass*, without doubt, and in quantities that will pay better (for the amount of labor) than any farming ever undertaken. The black bass of our lakes is a superior fish to the brook trout, both for the table and for sport, and will do well in water where the summer temperature is up to seventy-five degrees Fahrenheit.

Old Bones.

Mr. C. L. Brooks, Anna, Ill., wrote that there is no mill nearer than 300 miles, and he would know the best method to prepare bones for application to asparagus without more machinery than a farmer can make for himself or get cheaply.

Mr. Fuller.—Dissolve them as he has occasion to require. If he has ashes enough, and can wait, he might mix them with the bones, and they will become fit for use in, say, six months or so.

Mr. Ely.—There is a process which I remember to have heard described, that is to bend over a small sapling, attach a heavy stone to the top, and work it after the manner of a trip-hammer.

Mr. Bruen.—If he has plenty of barn yard manure, he might get along very well, so far as asparagus goes, without the use of bones at all.

Adjourned.

November 23, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

The Preservation of Eggs.

Mr. F. D. Curtis.—I am not exactly prepared to say what process is best, but I can speak with authority against ashes, which are a perfect failure, and against lime, which depreciates the price in market fully fifty per cent. A new notion is to pour hot water over the eggs, and then pack them in salt. I have no experimental information of its feasibility.

Mr. D. B. Bruen.—Salt, Mr. Chairman, salt is the word. My wife always uses it, and I have always found the eggs thus kept excellent, even several months after. Captain Smyrna adopts the same practice, with success, in his long voyages.

Dr. J. V. C. Smith.—The mode in vogue in Russia, and held in high esteem in Europe, is to pack the eggs in a cask, small end downward, and pour melted tallow over them. For transportation this plan has special attractions, and, as a general thing, I am disposed to think it the best way.

Mr. J. W. Gregory.—I have seen the recommendation to which Mr. Curtis referred, and I believe the practice of those who adopt it is to put the eggs in a basket, and dip them in boiling water for thirty seconds.

The Chairman.—You all do know that we had here on a previous occasion some eggs which were fourteen months old. They were preserved by Professor Nyce in his refrigerator building, a system, by the way, which is not so impossible of general adoption as might seem. Each and every house owner ought to have, and might have at moderate expense, something similar on a small scale. Butchers have got hold of the idea, and use it in their ice boxes.

The Physiology of Eggs.

Dr. J. V. C. Smith gave the Club a valuable, though brief lecture on this subject. Every fowl has two small organs near the extremity of the body, called the ovaria. It is filled with elastic tissue, and feels under the finger like sponge. The eggs are started here, and those which will mature a year, or two or three years hence, are in embryo. One is forced up, is seized by the stroma, which is seventeen inches long, and passed rapidly through. When the egg leaves the ovary, it consists of yolk only, but in its passage through that short canal, the yolk is surrounded by enough albumen to perfect the chick. The white of the egg has in it all that nature requires for making bones, muscles, blood vessels, connecting tissue, skin and feathers. Just before the egg leaves the body, this canal has the power of secreting lime for the shell. This shows how valuable the egg is as nutriment, and it also shows what demands are made for rich food by a hen that lays an egg daily. Beside what she requires for her substance, she is called upon to secrete the material for the body of an entire chick, and also retain for the little creature sufficient to last many hours after it leaves the shell. It shows also that a hen cannot

make albumen so rapidly, except out of albuminous food, such as wheat, meat, and small animals. It is not true that there is a certain number of eggs, and that, this number exhausted, no more can be expected; but it is true that the secretions lessen as old age comes on, and latterly the hen fails to have sufficient force to carry forward the process. The practical bearing of this is, that we must see that the fowl is always well kept. The way to have good laying pullets is to quicken the circulation and strengthen the system by liberal nutriment. In conclusion, the speaker referred to the fact that the yolk is food for the young for the first three or four days; that careful housewives make a mistake by attempting to feed them before the expiration of this time. Let the mother bird have charge, and success will be certain, for she knows better than any man can what the chick requires.

Soils and Grasses from the Far West.

Mr. N. C. Meeker, who has recently returned from an extended tour through the far west, presented specimens, and spoke as follows: I have often thought that if travelers would accurately describe the common life of the people of distant lands, their accounts would be of great interest. If, in addition, they should bring samples of the soil, of the ground on which the people tread, they would give us something still more interesting; and I have wished to see dust taken from the vicinity of Rome, Athens and Jerusalem. We suppose, of course, that there is mud in England, France, Italy, Greece, and the Holy Land, and that the common objects of nature are the same as here; the sun and the stars shining; but these countries are so remote, and they are associated with historical objects so much more important than in our own land, that we easily imagine a condition of things in these far countries brighter and better than anything with which we are familiar. In a recent trip across the plains to the Rocky mountains, I was mindful of what I had wished other travelers had done, and accordingly I made a collection of grasses, soils, and some other common objects, which I present for your inspection. The distance traveled was about 2,500 miles, that is as far as through England, France, Italy and Germany, and inasmuch as it was upon our own soil, it has been a pleasure to make the small collection, and, in addition, to note the magnificence of scenery, to be described in another connection, for I am thoroughly convinced that we have in our own land full as much that is worthy the attention of tourists

and people of means and leisure, as can be found in any other part of the globe. The first peculiarity on going westward will be the prairies and prairie grass. This grass resembles swamp or salt grass, growing coarse and tall, and it extends westward to the center of Kansas and Nebraska, and from British America into Texas. Hence, it covers a country 700 miles wide and 1,200 miles long.

As a specimen of the soil on which the grass grows, I present a sample taken from the college farm of the Agricultural college of Kansas, at Manhattan, 118 miles west of the Missouri river. I also present a sample of gypsum from near Salina, 184 miles west of the Missouri, where it is found so abundantly that thousands of wagon loads can be obtained from the bluffs of the streams. The prairie grass in this section is superior to that growing west—said to be equal to timothy, and for the reason that there is less rain. Coal is found all through this country, and as far west as Fort Harker, 218 miles, and I present a specimen which is lignate; it contains neither sulphur nor offensive gas, and it burns wholly to ashes.

Two hundred miles west of the Missouri, and on the center line of the State of Kansas, the prairie grass wholly disappears, and is succeeded by the buffalo grass, a specimen of which is here presented. It grows from six to eight inches high, is short and densely tufted, sending off stolons or runners, and it flowers in June. It extends from Texas to British America, and to the State line of Kansas on the west; hence it has an area of 1,200 miles from north to south, and 200 miles from east to west. It is stated that this grass grew abundantly sixty-five miles to the eastward of the present limit; that as the buffalo disappear it disappears also, and that the prairie grass takes its place when frequent rains appear. It would seem from this that the prairie grass gathers moisture, as it well might, since it covers the ground and forms a shade; hence dews gather, and hence the rain. If this theory is correct, it should follow that the prairies of Illinois were once covered with buffalo grass; that then there were no dews and few showers, and that the disappearance of the buffalo has produced a change in the climate. This buffalo grass, as I saw it in October, had a light color, the same as this sample, was crisp and dry, and gave the whole country, as far as the eye could reach, the appearance of a meadow in July, just after the grass is mown.

We had entered upon this grass about forty miles before any buffaloes were seen, and they were at quite a distance, in a small herd of fifteen or twenty-five, as quietly feeding as cattle in a pasture. In an

hour or so we passed a herd much nearer; they were alarmed, and ran in an awkward manner, but still quite fast. About the same time a herd of antelopes, with much white on their bodies, were seen. These may be called the deer of the plain, for they are similar to common deer. For several miles they ran parallel with the train, now hidden as a swell in the ground intervened, and now rising in full view, and gliding with great speed and beauty. The sight was similar to horses on a distant race course doing their best. About noon the gentlemen of the New York party ordered the train to stop, for as it was a special train for their service, they could do as they pleased, and they went out over the plain with their guns to kill buffalo, which were in sight, but their success was not worthy of especial note.

Here, from an excavation, I selected a specimen of rotten limestone, which seems to underlie the whole country, and I obtained also those moss agates, which come from a bluff on the Smoky Hill, at no great distance. They are found in great abundance in other parts of the country, and are, at present, much in fashion in setting for rings, breastpins, and other jewelry, as they take a brilliant polish when cut. Passing on our way we saw buffalo and antelope frequently, but none very near. Not a tree or bush of any kind was to be seen in any direction, and the most noticeable objects were the telegraph poles. The soil was not quite so dark as that I have exhibited, and it had more gravel; still it was rich, and was from two to three feet deep. Of this I took particular notice, for we were in the center of what has long been called the Great American Desert. Our course was on the divide between the Smoky Hill and Saline, neither of which were in sight, but it is to be said that to the north are numerous streams, such as the Solomon and Republican, with numerous tributaries, where timber grows and where land can be cultivated with profit; but few white people have visited the region, and it is occupied by hostile Indians. As the sun was going down we passed a herd of buffalo, which seemed preparing to lay down for the night as in a meadow, and, as they were quite near, the train went slow. Repeating rifles were fired from the car windows, and as rapidly as if a battle were in progress, and two fell. The train stopped, and the hind-quarters and heads were taken aboard. Their weight was about 1,400 pounds each. A large, wild animal will weigh from 1,600 to 1,800 pounds.

At Sheridan, which at present is the western terminus of the Kan-

sas Pacific Railroad, I selected two average specimens of soil; one from the surface and one two feet deep. It will be seen that the surface soil is remarkably rich; indeed, as rich as any soil in the country, and that the subsoil is equal to the virgin soil of such timber countries as western New York, Ohio, or Michigan. When the buffalo grass ends the grama grass begins, and extends to the foot, and even into the Rocky mountains. This grows in bunches or tufts ten or twelve inches high; the seeds are held firm, the roots are firm, and flowers in July and August. It is the most nutritious grass known; cattle fed on it are good beef the year round, and working cattle in that country are never fed on grain, and do not know what it is.

From Cheyenne Wells, 450 miles from the Missouri river, I took this specimen of subsoil two feet below the surface, and it will be seen to be rich in the elements of fertility. It was nearly as dry then as now, and the people at the stage station said there had been no rain since June, nor even dew, and yet they had an excellent well of water about ten feet deep. In other places they dig from fifteen to forty feet. In one place they had gone 100 feet and got no water. I think that a plenty of water can be had in from twenty to thirty feet, and that if it were pumped with a wind-mill into a large reservoir made in the soil, a few acres could be irrigated, and abundance of bread-stuffs and vegetables could be grown, while stock could be kept to any extent; and it is in this way that that country can be settled and trees made to grow. Besides this, the railroad company is about to sink artesian wells. Geologists say the formation is favorable for the holding of large bodies of water underneath, and it is alleged that such bodies must exist, since the water from the Rocky mountains finds its way only in part into the rivers flowing from them. A portion of country, perhaps fifty miles wide, was passed over in the night, during which period we crossed eight miles of sandy land, which was the only sand on the whole journey of 700 miles.

On the Arkansas river, above Bent's Fort, I noticed swelling ridges of shale similar to that where fine grapes are grown in western New York and in northern Ohio. This is a specimen of that shale. Being in a state of constant decomposition, the soil of the valley is made very rich. The river is clear and sparkling, the water cold, as it should be, since it is derived from melting snows in the mountains here, only about eighty miles distant. A few cottonwood trees were along the banks, and, although the country is decidedly healthful, and is beautiful and rich, there are few or no inhabitants. All

of the upper part of this valley, that is, through a distance of about 400 miles, requires irrigation, but the river has a fall of about fifteen feet to the mile, and its waters can be carried out into the country twenty miles on each side. There are many tributaries of this river, with wide valleys, all of which can be irrigated, and I estimate that a country equal to Massachusetts, Connecticut, Rhode Island, and Vermont can be brought into cultivation and made to sustain an immense population. One of these tributaries is the Huerfeno, 650 miles from the Missouri, on which Col. Craig has a plantation of 2,500 acres, flowed from the ditches, which, in some places, run around the side of the hills as much as 100 feet above the valley. Col. Craig lives five miles from a neighbor, but he has an elegant mansion, and he conducts farming on a large scale.

To give you an idea of what the soil there is capable of producing, I present a sample of the heads of timothy grass which Col. Craig requested me to exhibit to this Club. The timothy must have been as much as six feet high, and it is seen that the heads are from seven to eight inches long. And yet, well as it grows, there is no use for it, because the grass of the country is abundant, and because it is eaten from the ground all winter. The cactus grows here to an immense size, and of course is covered with sharp spines, and therefore I must be excused for not bringing a specimen. The soap plant, or Spanish needle, grows abundantly; the Mexican women use the root for soap, and it is said also to be valuable for paper stock and for rope. The sample I present is quite small. This package of soil I took from Idaho, a town over forty miles west of Denver, and well in among the Rocky mountains. A richer soil scarcely can be found in any part of the country, and it is clear that it was derived from a decomposition of the primitive rocks.

Now, from all that I can see, and guided by Agassiz's theory of glacial action, I am willing to believe that the soil of the great plains and even of Iowa, Minnesota and Illinois, are in a great measure derived from the crushing down of the front ranks of the Rocky mountains. That the rocks of these mountains have been ground up in a most wonderful manner by some tremendous power, long in action, is demonstrated by this specimen of glacial conglomerate, which I obtained at Cherry Creek where gold was first discovered. It is composed of pebbles so small as to be like fine gravel, which are cemented together by a lime rock ground finer than they, and forming with sand and water a cement. I think we can understand from

this why the prairies and all the valleys of our western streams are so extremely fertile. The region nearest the mountains contains the most minerals, for it would sink soonest; and hence we cannot fail to see that the soil of the country which hitherto has been called the American desert is really the richest of all our broad domain. I show now a specimen of Colorado wheat, which probably is the best wheat in the world, and I have abundant evidence that the yield was fully forty bushels to the acre.

A Grape Test.

Mr. A. J. Caywood exhibited three boxes of grapes, Isabella and Catawba, from the Vine Valley Grape-growers' Company, of Canandaigua lake; also a box of Catawbas from Hezekiah Green, of the same place. The juice of the Catawbas was tested by a special committee with a saccharometer. With this instrument the grapes are placed in a thick cloth and the juice extracted by wringing the cloth. The juice is put in a glass cylinder, and the saccharometer inserted. The Vine Company's stood at eighty-seven degrees; Mr. Green's at eighty-five degrees. Specimens of the grapes were passed around among the members, who observed that the Catawbas were very sweet, and the best tasted by the Club this fall. It was stated that the foilage of the vines in Vine Valley is not destroyed by frost so early by three weeks as in other sections of western New York. As an instance of the great difference in grapes as to the amount of sugar they contain, Mr. C. alluded to a recent official test of the Walter grape by which it appeared that this remarkable seedling shows 104 degrees. No grape is good for wine that does not show well by this test, for no addition of cane sugar can supply the place of the grape sugar which nature develops in the choice varieties. This remarkable sweetness of the Walter, recommends it for the table as well as for wine-making purposes.

Self-milking Cows.

Mr. James Miller, of Penn Yan, N. Y., gave the following as his method of preventing a cow sucking herself. It requires the head part of a leather halter, with a ring and a piece of chain of small size, eight inches long, a stick two and a half feet long, about an inch and a half in diameter, and a leather circingle. Have the stick fastened to the chain with a piece of round iron flattened at each end, so that it can be riveted on, and leave a bow projecting beyond the end of

the stick, an inch or more; an iron upon the other end, fastened in the same manner, projecting enough to allow the circingle to pass through, completes the arrangement. Put the halter on first, with the stick attached, as described above; pass the stick between the forward legs; put the circingle through the iron on the back end of the stick; buckle it round the cow. It will give her a good deal of liberty with her head, and does not injure her. In some cases it will break the habit.

Wheat and its Cultivation.

Hon. George Geddes, Fairmount, Onondaga county, N. Y.—Wherever good wheat can be produced, the flour made from it, will be the material most used for making bread. The more advanced in civilization any people may become, the more certain it is, that they will use this material for bread; and thus it happens that countries whose soil and climate do not favor the production of wheat, if the inhabitants have sufficient wealth, will import largely their breadstuffs from more favored regions. There is no substitute for the wheaten loaf, to him who has once become habituated to the enjoyment of it, and there is no grain, with the exception of rice, that is so extensively used as food for man. The almost universal demand for wheat flour, and the fact that but a small proportion of the earth is well adapted to its perfect production, renders it certain that choice wheat lands will continue in the future, as in the past, to be held as of great value. Communities that raise a surplus of wheat beyond their own wants, will generally be found to be every way prosperous, refined and cultivated, just about in the degree that this grain is made their leading staple. It would be difficult to assign too high a value to first-rate wheat lands; and in a national point of view, it is likely that the possession of great districts of country that are well adapted to the production of wheat, will continue to produce a marked influence on the habits and prosperity of the people. Nations that eat bread made from wheat, will reach and maintain the highest plane of civilization. Anything that leads to the more economical production, and to the extension of the profitable culture of wheat, aids not only in promoting individual and national wealth, but is a blessing to the great mass of men, and especially to the poor. We want cheap wheat, that is produced at a profit. The object of what follows, is, if possible, to aid in bringing about this desirable end.

WINTER WHEAT.

The soils best adapted to the profitable cultivation of winter wheat have a large proportion of clay and lime in their composition, with sufficient sand to prevent the formation of hard masses or lumps during the process of cultivation in moist weather. Such a soil is usually called a "clayey loam," and the springs of water that flow from it will be so impregnated with lime as to render it too hard to use for washing purposes. The trees that are usually produced spontaneously by such lands will be mostly of the harder kinds of wood, the oaks abounding. This description is not intended to be either scientific or minute, but to indicate the leading characteristics with sufficient accucracy to enable the mere traveler, as he passes along, to judge of the capacities of an unsettled country so far as the soil alone can indicate. In settled districts, the practices of the farmers will be a certain test of the wheat-producing powers of the land, for it is certain that where winter wheat may be said to be a natural crop, there it will be grown in preference to any other.

WINTER WHEAT REQUIRES A WELL DRAINED SOIL.

Some lands are perfectly drained by nature; other lands, though they may have every constituent that the agricultural chemist would desire, will not raise wheat without artificial drainage, at a great cost. The more clay abounds the more elaborate must be this artificial draining. Sandy loams, with open porous subsoils, generally require but little artificial draining, and this is strikingly true when the land is but just cleared of the forest. While the roots of the trees are decaying and making channels through the subsoil, many farms are able to produce wheat in perfection, that refuse to do so after the land has been under cultivation many years, and these root-made channels have become obliterated. This I have seen over wide-spread areas. When the land was new it was dry enough; when plowed for many years, it had become so heavy that in wet times it was nearly mortar, and in dry times hard, indurated, and filled with cracks. Thorough draining is then the only remedy, and if clay predominates, it is the certain remedy. Undrained clay lands are never worn out, for the owner that lacks the energy to free them from stagnant water, never has force enough to exhaust their fertility by cropping. Manure on such land is nearly thrown away. Draining is the first thing to be done, next thorough cultivation, then manure. Whoever reverses this order throws away his money and his labor. There are some

limited districts of country, where the soil has been formed from disintegrated shale, or soft rock, that was so constituted that it has given sufficient consistency to make good wheat land. The subsoil, or rather the underlying rock being full of cracks and seams, allows all surplus water to escape, thus perfectly draining every square foot. The owner of such land is fortunate, if the rock is only made of the right materials. There is but little of this peculiarly formed land. Most lands that are usually called "clayey loams," are due to an entirely different process of nature. The clay was deposited in water in thin layers, divided by lamina of sand. Water passes very slowly down through such a soil, though it will drain horizontally very rapidly, finding its way along the thin layers of sand. In such a soil tile draining is at once very effective.

There are clays in which the silicious matter is not in layers but distributed through the whole mass of clay. These lands are very difficult to drain, and require drains to be very close together to make them suitable to raise wheat.

In the selection of farms, it is very common to prefer the sandy loams, because of their being more easy of cultivation, and more free from stagnant water, but if the object is to raise winter wheat, it will be found in the end that the more clayey soils are the most valuable, from the fact that they are more enduring and make better returns for the manure that is put on them.

Either extreme, too much sand or too much clay, should be avoided in selecting a wheat farm. The experienced farmer will find no difficulty in knowing when he has found just the true mean ; the unskilled may derive some benefit from the hints I have given.

While clayey loams are best adapted to the profitable production of winter wheat, it is well to remark that there are other soils, such as gravels, sands and the like, on which crops of wheat are constantly grown. By using hardy varieties of wheat, I have raised fair crops on alluvium, once a perfect swamp, that had been deposited by the freshets of a brook, but the water of this brook has much lime in it, and the alluvium in some places approaches and is, in fact, an earthly marl. On all the inferior wheat lands, the crop is subject to disease and to great injury from the depredations of insects, not having the power to outgrow and overcome these enemies. High manuring and perfect cultivation are absolutely necessary to secure average crops on these lands, and so forced must be the farming that even in new countries the owners of such lands very soon find that they can put

them to more profitable uses. Spring wheat will be raised for a while perhaps, but finally the whole country will be devoted to dairy or other purposes that compensate the cultivators of the lands much better than the returns from wheat. Thus the aggregate production of wheat is constantly falling off in all the older States. New lands are brought into cultivation as population extends west, and the first effort of their owners is to raise wheat, and they continue its production, in many cases, long after it has ceased to be a remunerating crop, for wheat raisers are always reluctant to give up the contest.

The true wheat lands are such as will continue for ages to raise good crops, when properly cultivated and managed. The proportion that such lands bears to the whole area of our county is much smaller than is generally supposed. The Hon. Theodore C. Peters in his very able report, as one of the State Assessors of New York, published in the Transactions of the New York State Agricultural Society for the year 1863, estimates the area of the wheat lands to be only thirteen per cent of the whole State, while he assigns to the dairy thirty-five per cent. Of this thirteen per cent of wheat land, he says (page 354) that forty-one acres in every 100 of improved land, is devoted to pastures and meadows; and from his figures it appears that of the 2,600,209 acres of improved land adapted to the raising of wheat, only 407,019 actually raised wheat in the year 1860. These figures of Mr. Peters show how limited is the area of the true wheat lands in the Empire State, and they should teach their owners something of their great value.

CULTIVATION OF LAND FOR WINTER WHEAT.

Imagining ourselves to be placed in a good climate and on a good wheat soil, that is free from all stagnant water, and free from all stumps, stones, or other obstructions to perfect cultivation, we inquire as to what is the first thing to be done to raise a good crop.

Of all the cereals, wheat demands that the soil should be pulverized in the most perfect manner, and if the soil is naturally stiff and hard, it must be broken to a considerable depth, that the roots may readily penetrate the subsoil. This is the object and end aimed at in all the plowing and harrowing that goes before sowing the seed. The cheapest way of doing the work is the best, providing it is really done. When the country was new, and the land had been but little cultivated, this was a laborious process, and generally required several plowings and harrowings. Judicious treatment of clayey lands, while

raising grass or grain crops in the rotation, will make the process of fitting it for wheat laborious and expensive. It is usual to put Indian corn on a clover sod as the first crop in rotation, and some unwise farmers allow their cattle to run on the corn stubble in the fall, and poach up the clay while wet, turning it into what the engineers call "puddle." No practice deserves more censure than this. The next spring, when clayey land that has been thus mismanaged is plowed, it will turn up in hard lumps that can only be broken up at great cost; and, too, it will take much more power to draw the plow than it would if no cattle had been allowed on the land the fall before. If the land abounds in sand all this is changed. Sandy land generally requires compression, and the feet of cattle and sheep are often judiciously employed for this purpose.

Clayey Land must not be Plowed When Too Wet.

I mean when there is stagnant water in it. All good soils are composed of minute particles that will hold a certain quantity of water, which is necessary to all crops. Excess of water is known as such as these particles can hold by its being confined, and that would drain away if allowed to do so. Immediately after a heavy rain all soils are saturated with this redundant water, and at such times the wise farmer will neither cultivate his land or allow heavy animals to trample upon it. The more perfect the drainage of the land, the sooner this excess of water will pass away, then comes the time that the skillful man will till his land. If clayey land is allowed to become too dry, it is not only hard to plow, but the work cannot be so well done as it can at the time that the land is just in the right condition as to moisture. Practical skill alone can decide as to the best time, all things considered, to cultivate so as to have labor expended in the most judicious manner.

Now, assuming that we have land that has been well managed, one plowing will completely pulverize it, if this plowing is done at the right time and in the most skillful manner. Narrow furrows, made by plows just adapted in the shape of their mold boards to the land, are necessary. Complete disintegration of the particles is effected by just moving them on each other, and it is not necessary to lift the furrow slice high up, or move it far, to do this; the least breaking of the cohesion is sufficient. The harrow follows to level the surface, and more perfectly prepare the seed bed.

It may, and often will happen, that by reason of wet weather or

bad management, there will, in clay soils, be some small lumps after the plowing and harrowing has been done. In such a case the roller or clod-crusher must be used to reduce these lumps to powder.

Next comes the drill to sow the seed in. A good drill following the roller not only sows the seed in the best manner, but it cultivates the land far better than any harrow. The drill spouts lift the surface soil and throw it into ridges, that by falling back cover the seed lightly at first, and still deeper as the weather acts upon them during the fall, winter, and following spring, when alternate frosts and thaws are expected. The rougher the drill leaves the surface of the land the better; and there is no greater mistake than to roll clayey lands in the fall, *after* the seed is sown.

In open winters the land will for many weeks be frozen hard and exposed to the winds, uncovered by snow. In such cases, gales will drive the dust made of the frozen earth, sometimes to great distances. If the young wheat plants, growing from the bottom of the trenches, made by the drill spouts, have a ridge to the windward of them, they will be planted deeper by these gales; while if the ground was left level, the plants on ridges and the more exposed places will have all the earth blown away from them, and their roots exposed and killed by the unpropitious season. The drill is a most important farm implement to the raiser of winter wheat, planting all the seed to a uniform depth, and raising a barrier to protect feeble plants from winter killing. But these barriers must be left until the trying period has passed in the spring; then the roller should be used for the double purpose of leveling the ground, so that the reaper will move smoothly over it in time of harvest, and for the further object of breaking up and crushing the surface soil after the rains and frosts of early spring are passed. This rolling, if done at the right time, is of great value to young wheat, and assists materially in covering the clover seed, but it must not be done until after the clover seed has been sown.

In sections of country that are subject to open winters, it is advisable to run the drill at right angles to the direction of the prevailing winds. I have observed this in my own farming with advantage, and in cases where it was necessary to cross the line of the winds I have drilled the field diagonally.

NAKED SUMMER FALLOWING.

When the country was new, the land abounding in the stumps of forest trees, and more or less loose stones, made the perfect plowing

of land impossible, summer fallows, as has been intimated, were necessary for the successful production of wheat. Really, three plowings in those days did not cultivate the land as perfectly as one does now that all these obstructions are away. To work among the stumps, we necessarily used plows that were short and sharp in the twist of the mold-board. Now our plows enter the ground at a more acute angle, run deep, and not only reverse every part of the furrow-slice, but they crack and pulverize the whole mass. Not a balk is left by a good plowman, and every part of the soil is worked in the most perfect manner. This being so, why waste the whole season in the useless labor of repeated plowings and harrowings? The only answer that can be made is, our fathers did so, and taught us to do so.

To state this a little more fully: Let us suppose that we have a clover field that we intend to sow to wheat. One way of doing the work will be to plow under the sod soon after corn-planting, say early in June, harrow the ground down level and smooth. There let it rest until after harvest, and then in August plow again and harrow as before. About the first day of September plow the third time, harrow and sow the wheat. Thus we have the old fashioned naked fallow, and have not only done much hard work and lost all use of the land from the first of June, but we have exposed the soil by repeated working to the air and sun, and killed all the grass and most of the weeds that there were in it. This killing of foul stuff is the gain we have made, and in cases where the land is very foul, this great labor may not only be justified, but may be well laid out, as the only means of getting rid of certain noxious weeds; but this is the only justification for a summer fallow of this kind, where there are no obstructions in the way of thorough plowing. Let us compare this with another way of treating the land.

Plow early in the spring, if the land was not plowed the fall before; sow barley or oats on it. Harvest the crop; glean up with a steel-toothed rake, hung on wheels drawn by a horse and rode by the owner, all the straw, leaving as little of the barley and oats as possible on the land. Plow at once, if the land is foul, and harrow well. This will cause all the grain that shelled to grow, and also start the seeds of weeds. From the time the spring crop of barley or oats is harvested to the time to sow wheat, five or six weeks will elapse of the best weather of the whole season to exterminate foul stuff. If this time is well employed and the season is dry and warm, much

may be done by two plowings and as many harrowings, to make the land clean for the wheat.

Just the same work has been done as in the case of the naked fallow, in the way of cultivation, and we have our crop of barley or oats, that will not only pay for all the work, but will give a very liberal interest on the value of the land. Unless the land is quite foul with weeds, only one plowing is necessary after the spring crop is taken off. A good clover sod turned under in the spring will so decay that when it is turned up again, just before the wheat is to be sown, the ground will be covered with evenly distributed manure in its best condition, and at the best place, to give life and vigor to the young wheat plants.

I have tried, and seen tried, one, two and three plowings between the harvesting of the spring crop and the sowing of the wheat, and am convinced that it is only in very rare cases that it is necessary to resort to the naked fallow: and in such cases the work should begin the year before the wheat is to be sown, and the land be cultivated as often as the noxious weeds show themselves during all the season, up to wheat sowing. Where all this work is necessary the farmer is engaged in killing weeds, rather than in raising wheat, and he will probably find that his crop of wheat barely pays for the labor.

This plan of raising wheat after a spring crop has been extensively followed in this vicinity, and with entire success, by our best farmers, and they very rarely resort to a naked fallow, though winter wheat is their leading crop, and their average is over twenty-five bushels to the acre, and their lands are growing cleaner year by year.

It is very common here to pasture a clover field up to the latter part of August, and then, by one perfect plowing, reverse the sod, and perhaps spread a light dressing of barnyard manure, that has been well rotted, on the furrows, then level down with a harrow and drill in the wheat. Sometimes the clover is made into hay where the land is not required for pasture. By this treatment I have seen very large crops of wheat raised, and at less cost per bushel than by any other process. Lands that are heavy, that is, lands in which clay is in excess, it is advisable to plow earlier than the latter part of August, and by means of the harrow and steel-toothed cultivator keep down all weeds and keep mellow the surface of the soil. More time is thus given to draw and spread the barnyard manure and to allow the sod to decay and benefit the young wheat.

QUANTITY OF SEED REQUIRED FOR AN ACRE.

This depends somewhat on the variety, and the time and manner of sowing. The tendency among wheat raisers has of late years been to the use of less seed than formerly. This is perhaps in part due to the general use of the drill. Thirty years ago few farmers here sowed less than two bushels to the acre, but it was sowed by hand broad-cast, and then harrowed; some of the seed would get so deep that it did not come up, some lay on the surface, and was food for the birds. The introduction of the drill enabled us to put all our seed at the desired depth, and thus secure the growth of every grain, and now few farmers here use more than a bushel and a half to the acre. Mr. John Johnston, who is an acknowledged authority among us, told me last summer that one bushel and an eighth of Deihl wheat was as much as should be sown on an acre. Too heavy seeding is not only a loss of the grain, but it causes the crop to fall, and thus lead to a more serious loss, and to extra expense in harvesting. Wheat that has a large berry, will have less in number in a given quantity by measure, than the smaller varieties, and of course more by measure will be required. The general tendency is, however, not only here but in England to lighter seeding, and many experiments made in both countries go to show that half a bushel or even less of seed would be sufficient to furnish all the plants necessary for an acre, could we rely on preserving every plant alive through the winter and spring. For Mediterranean wheat a bushel and a half is generally sown; for Treadwell and Weeks being smaller in the berry, a little less is admissible, when sown early, and on ground in first rate condition.

TIME OF SOWING.

Like many other matters in managing a farm, this is a point in regard to which no positive directions can be given; only general suggestions and advice are admissible.

The leading object is, to have the young wheat strong in the root, without too much top, before snow comes or the ground freezes up in the beginning of winter. Most experienced wheat growers would probably say that they had lost more by sowing too early than by sowing too late. In this latitude (forty-three degrees) my own opinion favors the ten days from the 15th to the 25th of September in ordinary seasons. Wheat sown from the 1st to the 10th of September has generally grown too much top to winter well with me; and

the Hessian fly is very apt to make his lodgment in early sown wheat. If the sowing is deferred until the frosts may be expected to destroy the fly before the plants are sufficiently grown for it to take possession, and the land is in high condition, we usually avoid the fly and secure sufficient fall growth by sowing about the 20th of September. The objection to large growth in the fall is the liability of having the wheat smothered under deep snows, that sometimes remain on the ground for three months or more. Unless the ground is frozen hard before the snow falls, heavy drifts will winter-kill wheat that has a large top.

HARVESTING WHEAT.

Much has been said in favor of cutting wheat early, while hardly out of the milk. This is bad advice for many reasons. The farmer gets less wheat than he does if he delays cutting until the berry is too hard to flatten under the pressure of the fingers. The time required to cure unripe wheat is so great, that there is great danger of rains wetting it more than once before it is ready to be put into the barn. Less labor will be required to harvest and secure a crop of wheat by allowing it to stand as long as possible without having the grain waste by shelling in the handling. Farmers that raise large crops will necessarily cut some of it as early as it will do, and then perhaps not be done with harvest before something will be lost by shelling. That part of the crop that is just ripe enough to be drawn the same day it is cut, will go into the barn with the least cost.

It is curious to see farmers, living side by side, adopt entirely different practices as regards the conduct of a harvest. One will go on and cut his whole crop before he draws any to the barn, then draw it all in at one job if he can. His neighbor will secure his crop in the barn as fast as it is fit to be housed. He will stop cutting, if necessary, to do this, preferring that his grain should be wet by showers while standing than in the bundle. Wheat in the sheaf, once fairly drenched with rain, requires three days of good weather to fit it for the barn. The danger of wheat sprouting is always to be kept in mind, and though in very good weather a crop of wheat will be best harvested by cutting the whole crop, and then securing it, it is safer to adopt the plan of drawing as fast as ready. Our own unvarying rule is, secure the crop at the earliest moment.

Improvement of Seed.

It is not necessary for me to dwell on the importance of raising no foul stuff with wheat. I am no believer in the turning of wheat into chess or anything else; but I am a believer in clean land and entirely clean and sound seed, and thorough cultivation; and I believe that our wheat crops might be greatly improved in quality and increased in quantity by careful selection of seed. Let a farmer first determine the best variety for him to raise. At or before the time of thrashing, set some sheaves on a floor, heads upward, and then draw out the most perfect heads, those of the greatest length and the best filled, until he has enough to sow an acre. Put this selected seed on land in the best condition in every respect; weed the wheat the next spring. This acre should give him thirty or more bushels of seed for the next year. Out of this again draw the best heads, and sow an acre; and so go on for several years, the longer the better, and by-and-by he will have some seed wheat to sell that he may be willing to have bear his name, and he will be a public benefactor.

Adjourned.

November 30, 1869.

N. C. Ely, Esq., in the Chair; Mr. J. W. Chambers, Secretary.

Kansas.

A correspondent asks the Club their advice in relation to a location to settle in.

Dr. J. V. C. Smith.—I am a great admirer of Kansas, and am not informed of any more desirable locality to recommend.

The Chairman.—I have an excellent opinion of Kansas, especially since the fair of the Institute, at which fully 100 varieties of apples were shown from that State. They bore no mark of moth or curculio, and were certainly the finest on exhibition.

Mr. N. C. Meeker.—It must be remembered that Kansas fruits are the first fruits of the soil, and consequently are better than they will be by and by. When I was in Kansas, not many weeks ago, I tasted some of the fruit, and I found it in many instances spongy, like a man overgrown. However it is an excellent State to go to, provided one is sharp and smart. Those there now are of this character, and the new ones who come in must be posted or they get the worst of it. Further west even greater qualifications of this kind

are requisite. Next week I may take occasion to give somewhat more definite information bearing on this very subject.

CULTIVATION OF THE PLUM.

Mr. J. J. Babcock, Kalamazoo, Mich.—My remedy for the destroyers of this fruit is not one of my own discovery, but one practiced by several of my neighbors. Just across the street lives a man by the name of John P. Glover, who, this year and for a number of years past, has succeeded in raising several bushels of nice blue Damson plums, and he is not alone in this. Mr. Glover told me that he selected his grounds for his plum trees near his barn, planted them altogether, surrounded them with a tall picket fence, and made his hen house in the inclosure. He keeps from twenty to fifty hens. He also puts into this same inclosure two pigs; the hens are fond of insects; there being only a few of other kinds, they gather and swallow eagerly all, or nearly all, the curculio; should any escape the hens and sting the fruit, the fruit falls, and the pigs, being fond of plums, eat them at once. The pums I saw of his raising this season were free from stings, large, smooth and delicious, as they used to be thirty years ago, before the curculio was so destructive. The whole thing, from beginning to end, is most profitable. A plum orchard, a pig pen, and hen park, all on a small piece of ground. The eggs, pork and plums produced more money than could have been obtained had the ground and expense been applied to any other purpose.

Mr. Buckley.—I lived for some years in the handsome town from which this letter is written, and am familiar with the process explained. A man, by the name of Cobb, was the first to put it into practice, and, as stated, the results have been very satisfactory.

Dr. J. V. C. Smith.—Our friend, the entomologist of New Jersey, has repeatedly made the same recommendation, or something similar, and, if my memory serves me, his suggestion has not been uniformly received with the credence it is now shown to deserve.

Dr. Isaac P. Trimble.—The idea is not original with me, and I never claimed it. It originated, I think, with the father of J. J. Thomas, some forty years ago. It is practiced now with excellent results by Ellwanger & Barry, and by others. However, I have tried, as Dr. Smith remarks, more than once to pound the idea into the heads of the people.

The Chairman.—And I am afraid you have found the process a very difficult one.

Mr. F. D. Curtis.—In riding about the country I have frequently observed bottles suspended among the branches of trees, and, on inquiry, found they were filled with sweetened water, and intended as curculio traps. I have never tried this way myself, but know it is very generally practiced in Saratoga county, and persisted in there year after year.

Dr. Isaac P. Trimble.—I have tried it, and never caught a curculio; but I have caught scavanger flies, house flies and moths in great numbers.

Mr. J. D. Lyman.—In Cincinnati, recently, I saw a gentleman from Aberdeen, Miss., by the name of Phillips. He says the planters near him have rid themselves of the moth, the boll-worm and the army-worm by a lamp of simple construction. The top is left open, and the bowl containing the oil is shallow, so as to expose a good deal of surface. The moths fly to the flame, drop into the oil, and are drowned. He finds that one lamp of this sort burned for a short time in the evening, when the moth is laying her eggs, will protect an acre. A tin screen to windward keeps the lamp from being puffed out. Might not other moths, and possibly the incorrigible curculio, be lured to destruction in a similar manner?

KEEPING CIDER SWEET.

Mr. Frank D. Curtis.—I believe the Club never goes backward. Cider, to keep well, should be made in cold weather, from sound apples, and be kept in a cool place. The juice should be allowed to settle and then be drawn; or, as the cider-man would say, "racked off," at least three times, to clear it of the floating pomice, which will hasten and augment fermentation. It may then be put into strong bottles and corked up air-tight and kept in the cellar. In this way good cider will remain sweet a long time. If carbonate of lime be put into the cork it will arrest the fermentation of cider, but I do not fancy cider chemically prepared with any sort of drugs. It will have an unnatural taste, and is not so healthy. Cider is rectified and made much stronger by adding sugar, say ten pounds to the barrel, and a little brandy to give it flavor. The sugar increases the alcohol, and cider prepared in this manner will not readily ferment to the acetic or vinegar degree, but is very intoxicating, and, hence, should not be recommended. It is a favorite way with some to "rack off" the cider and put into the barrel ten pounds of raisins, which are said to have a sweetening and preserving effect.

A SHOW OF SOUTHERN STAPLES.

The Chairman called attention to the fact that Dr. Isaac P. Trimble had recently returned from an extended tour through the southern States, whence he went at the suggestion of the Club, and he asked him to take the stand and speak of what he heard and saw. Dr. Isaac P. Trimble said, in reply, that he met in Washington a large and influential company, among which was the Hon. Horace Capron, United States Commissioner of Agriculture, the Chairman of the Committee on Agriculture of the Senate, and other dignitaries. In this good society he went as far as Macon, where the Georgia State fair was in progress. Here was found an immense crowd, the hotels were overflowing, everybody seemed to be convened. However, good treatment was experienced. As to the exhibition itself it was the first since the war, and the wheels could not be expected to run very smoothly under the circumstances, and considering that the management was, for the most part, in inexperienced hands. The show of machinery, mostly from the north, was creditable, and a tournament brought out a fine display of horses, some of which were of fine blood. It was particularly observable that cotton was the entire burden of the song, and appliances for use in the cotton fields attracted special attention. Guano, phosphate, superphosphate, ammoniated superphosphate, nitrate of soda, &c., &c., are the charmed words that win every ear. Of oranges Dr. T. saw orchards of several hundred trees. Some of these trees were forty years old, and three feet in circumference. The land on which they stood is kept in perfect order by a system of shallow culture. No weeds were seen, Some of the trees, it was estimated, would yield from twenty-five to thirty-five bushels of excellent fruit. Very few apples were seen, and most of them came from New York. Some apple orchards, however, were observed near Petersburg. Peach trees were growing everywhere, but none showed the care they deserve. Marks of borer and curculio were painfully apparent. The first clover was found at Savannah, but the people of the south seem to know very little about clover. Whether it will grow generally, remains to be proved. The talk is all of cotton, what fertilizers they shall use to increase the yield, what charms, what mighty magic; these things fill every mind. In conclusion, the speaker promised to put upon paper, at another time, some fuller account of the interesting trip, and speak more especially of the condition and prospects of society in the south, and of the needs of the people. The remarks of the doctor were enliv-

ened by a display of various grasses, weeds and plants, more or less useful, most of which are curious in northern eyes.

Deep or Shallow Plowing.

Mr. D. L. Farrar, Buckfield, Me., wrote as follows: "I herewith send Dr. Trimble a full pardon for all the mischief he has caused by advocating three-inch plowing. I have never worked land yet where deep plowing was any benefit, and I have worked all kinds known in this State, and I make all my neighbors who favor deep plowing this offer: Divide the land to be plowed in two equal parts; plow one part three inches deep; apply the same amount of manure after plowing and before harrowing, all the other work being done equal. I will make up the crop the same as that grown on the deep plowed part, provided they will give me what more there is over and above what grows on the deep plowed part, and I will warrant better crops of hay after seeded to grass; and if Horace Greeley will make the same offer in favor of deep plowing, my word for it he will be bankrupt at the first harvest."

Dr. Isaac P. Trimble.—I can't help regarding this as an exceedingly sensible communication.

The Chairman.—Most people are pleased when absolved from their iniquities.

Mr. N. C. Meeker.—Mr. Greeley has raised a large crop of corn, the largest on the line of the Harlem road, I am told, on deep plowed land. I am going up to Chappaqua to see, and will take notes and report.

Dr. Isaac P. Trimble.—I have been there already, and a neighbor of Mr. Greeley told me he had to abandon deep plowing, and only got the crop of this season because he went down six inches and mixed his black muck with clay and gravel from the hills adjoining.

Mr. F. D. Curtis.—Whether deep or shallow, depends entirely on the quality of soil. Muck soil must not be stirred too much, neither sandy soil; but in a heavy clay loam it is well to go deep. In time of drouth, if you have a hard pan under clay loam, you will probably get very little harvest, but if you break up the hard pan and give the roots a chance to go down, the dry weather will have less ill effect.

Mr. Fuller.—I would add an appendix to all this, that it largely depends on the crops you purpose growing. If I plant grape vines or other vegetation, the roots of which have a habit of going deep, I

see that the top soil is placed down within their reach, but with wheat and certain other things, the practice ought to be different.

Mr. H. L. Reade.—I plowed the half of a field six to eight inches, and the other half three to four, and sowed rye. The harvest showed that the shallow plowed portion gave twenty per cent the best results.

Dr. Isaac P. Trimble.—I suggest that we let this subject lie over for the present. Meantime I would like those interested to note that converts to my theory are coming in as fast as possible. Truth is mighty and must prevail.

Removing Trees and Trimming Old Trees.

Mr. Chas. B. Skidmore asks the following questions: 1. Is it too late in the season to remove fruit trees and set them in other places? 2. Is it too late to trim old trees for bearing next year?

Mr. A. B. Crandell.—Too late, I should say for transplanting fruit trees unless he waits till the ground freezes, and takes up a large bole of earth with the roots. At any time between now and sugar weather in the spring, pruning may be done. February, during the mild weather is as good a month as any for using the knife and saw.

The same correspondent asks how to make

Hot Beds.

Mr. A. B. Crandell.—For hot beds, let him dig out his pits two feet deep. In February, he should throw in fresh horse droppings a foot deep, then three or four inches of dirt and tread all hard, then a thinner layer of horse manure and four inches of garden mould over that. Cover with sashes, keeping out the cold at the sides. The young plants must be carefully watched, and aired at the proper time. If he wants full and exact directions, one Peter Henderson, an opulent market gardener of Jersey City, will give him an admirable volume on the subject.

Middlemen.

Mr. W. H. Phelps, Middleport, N. Y., forwarded the subjoined communication: A little agitation is wanted in a new direction. There is an impression abroad among the farming community, which is quite general and of long standing, that the commission merchants of our great cities, New York not excepted, are dishonest men, and in many instances this impression amounts to positive knowledge. Instances are numerous in which farmers have been fleeced nearly and entirely out of their shipments of various commodities. We

have faith to believe there are some honest as well as dishonest men in the commission business, but the trouble is to find them. Now is there any way that the Club can come to our relief? We want the subject agitated. We know exactly what a great portion of the talk would be, but we would look for good to come of it. Please agitate in your own way, and should a radical reform be the consequence, so that hereafter farmers could ship their produce, especially their precious fruits, in tolerable safety, we would hail the era with exceeding great joy, and devote two days to thanksgiving and praise.

The Chairman.—I consider this subject an important one, and have caused the following resolution to be drawn up:

Resolved, That the Club appoint a committee to investigate the marketing of farm produce, and especially of fruits, in the city of New York, with the intention of informing the community whether a more economical system of disposing of farm produce may be practicable.

This was put to vote, passed unanimously, and a committee consisting of Messrs. Curtis, Crandell, Quinn, and Lyman were appointed.

MEAT SUPPLY OF NEW YORK.

Mr. J. B. Lyman offered the following resolution:

Resolved, That a committee of three be appointed by the chairman of this Club to investigate the present mode of the transit of cattle by railroads, with the view of suggesting improved methods of transportation, and inventions calculated to render the supplies of animal food more abundant and more wholesome.

Which was adopted, and Messrs. J. B. Lyman, Lewis Carr, and Geo. D. Alexander were appointed the committee.

KENTUCKY BLUE-GRASS.

Mr. S. P. Anderson, Franklin, West Va., would know how much seed of Kentucky blue-grass is required per acre, and whether to sow it in spring or fall to secure best results; also, where can he get the genuine article?

Mr. J. B. Lyman.—I returned a few days ago from the blue-grass region. He can get the genuine article at Lexington. Let him apply to the Regent of Kentucky University, who carries on the farm of Ashland, the home of Henry Clay. But the first question for him to settle is, whether he has a limestone soil. If he has not, timothy, red top, or orchard grass would grow just as well. The

peculiarities of the blue-grass counties are that a body of soft lime rock lies under all that region and constantly feeds the soil from the bottom. This lime contains some phosphate, as well as carbonate, and this accounts for the vigor of the growth of blue-grass all around Lexington.

Mr. F. D. Curtis.—I recommend orchard grass in place of Kentucky blue for the locality in question.

HONEY BEES.

Mr. O. F. Lyon, Pleasant Valley, Pa., has just bought a swarm of bees and put them in one of his upper chambers, the hive facing the window on the south side, and the window is raised enough to permit free egress and ingress. He would know if the honey-makers will do as well here as if they were out in the open air.

The Secretary.—I should say, judging from some facts which have come to my attention, that they would do better in quarters less confined.

Adjourned.

December 7, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

CHEAP ROOFS.

Introduced by a letter complaining that a roof laid with plastic slate gave a bad taste to the water.

Mr. J. M. Allen.—The roof in question was covered with some bogus composition, as the genuine article does not color water, because it does not disintegrate either when the water is soft or hard. I have seen water stand upon the mastic in a pail for days in hot sunshine, and remain as limpid as when it fell from the clouds. My house roof was covered with it, and my wife never saw any difference in the rain water, all of which we use. My balcony floor is a little concave, and is covered with plastic slate; it holds water like a dish till it evaporates, every time it rains, and has for three years. No color appears in the water, nor does a single drop ever get through it.

Mr. J. B. Lyman.—The difficulty with plastic slate is the shrinkage of the boards under the felt. They part the felt, unless it is thick and tough. The best of felt must be used and the roof-boards should be well seasoned. A friend of mine in New Jersey has a new way of laying a flat roof that is excellent. He uses felt with

coal tar, and covers that with slate laid close together in a new waterproof cement. I am having this style of roof laid on a residence I am putting up this fall, and find it costs less than tin and is much preferable.

Norway Oats.

Mr. Geo. M. Smith, Washington, Vt., forwarded some explanation of his processes in producing that large crop of Norway oats, namely, 126 bushels on 100 square rods of land with only seven pounds of seeds. "I first secured the above space, which was freest from weeds. It was broken greensward the spring previous, a good dressing of new stable manure being plowed in, and a good crop of 'common' oats taken from it that season; plowed as soon as oats were harvested, with no additional manuring; plowed again the spring following, and then eight loads of fine old manure was spread evenly over it. Then I kept a smart man with a smart pair of horses harrowing nearly all of one day, thoroughly mixing the fine manure with the mellow and even pulverized soil. Having but a small quantity of the seed, and as I had previously experimented with it and knew its disposition to send up numerous stalks from a single seed, I had it drilled, the drills being just one foot apart, and six inches in the drill, using as near one oat in a place as we could, covering them about two inches deep. After going over the piece we found we had less than one peck of seed, just seven pounds by weight. Nothing more was done to this field of Norways until the time of harvesting. The grain was then secured and thrashed, yielding 4,032 pounds of splendid oats."

Mr. J. B. Lyman.—I think especial importance should be attached to the statement made regarding the culture of the crop in question. I have examined several hundred letters giving similar accounts. It is also worthy of notice that a very small quantity of seed was used. Let farmers pursue a similar course with the common oats, and there will doubtless be less disparity in the relative results. The truth is that when a man gives two dollars or three dollars for a peck of oats he is sure to take uncommon pains. He will put them on good land, manure liberally, harrow fine and sow thin.

Mr. John Crane.—The yield noted seems very large, and the feet of my faith hesitate to take me so far. I have tried the Norway oats, sowing one bushel on three-fourths of an acre, and getting forty bushels in return. In my section of New Jersey the common varieties have degenerated, and my crop of Norways, though compara-

tively insignificant, was still such an advance on previous harvests as to bring up suggestion of the good old times.

Mr. H. L. Westerbury, Sextonville, Wisconsin, asked if the Club would recommend a young farmer of limited means to purchase ten bushels of Norways, at $7.50 per bushel, to make a crop in 1870. Are they worthy? Will they pay at that price for seeds?

Mr. Henry T. Williams.—Not unless he can sell them near home, among his neighbors. A bushel or so for one's own use may do well enough. The price next year will probably be greatly reduced, perhaps they will be as cheap then as the common oats.

Mr. Greeley's Crops.

The question was mooted the other day as to the depth of Mr. Greeley's plowing in his field at Chappaqua, and Mr. N. C. Meeker was sent by the Club to see and make report. He says: I found that a field of some twenty-five acres of land had been reclaimed by draining a swamp, and the results are worthy of notice, as there are millions of acres of similar swamp land in the Eastern States which for want of drainage are worthless. A part of this field was devoted to grass, and another was planted in corn. Mr. Greeley was not there, and I talked with his foreman, a German, who is said to be a careful, candid man, unlikely to misrepresent. This corn ground having become dry enough to plow, and having a soil rich, black, and mellow, much like the best prairie, was plowed twelve inches deep, when some roots of trees were turned out, and in planting the corn one ton of poudrette and two tons of superphosphates were applied in the hill. That the ground was rich enough to produce a fine crop of corn without manure I have no doubt. A farmer generally would have considered none necessary, but it was proposed to do the best that could be done, with the knowledge that even under such circumstances adverse influences are likely to operate. On looking at the corn in the cribs and elsewhere, I found it so good that a large portion was fit for seed, the ears were long and well filled, and the kernels plump and fully ripe. The yield was estimated at fifty bushels shelled corn to the acre, but this was on a basis of eight acres, when according to my judgment, there did not appear to have been more than seven acres, and this would give about sixty bushels to the acre. It is certain that so much corn has not been grown on the place for years, for the crib is full, and a portion having been put on an upper floor in the barn, the weight has broken a strong girt. With a con-

siderable stock on the place, and all fat, there is corn to sell. Now, it has been stated that the ground on which this corn grew had been covered with gravel four inches deep, and that plowing was shallow. It is true that a gravel hill was carted on a portion of this reclaimed marsh, but it was applied to the ground in grass, not to that in corn and the plowing, as I have said, was full twelve inches deep. To me it is a new idea that ground can be either too rich or be plowed too deep for corn, whatever may be its character, providing it is well drained. I will take the occasion to add that this farm, in its natural state, required a great deal of work to make it productive, but it seems to have been selected, and wisely so, with other views than of simple productiveness. The groves of oak, hickory, maple and evergreens, the rapid mountain stream, and the roaring waterfall in a dense forest, and the hills, glades, ravines, and nooks, beautified by touches of art, give a value to one seeking relief from city cares. A shelter belt of choice evergreens north of the green-house, and planted in rows, and now grown as much as fifty feet high, is noticeable. The branches of the outer rows are left untouched, and they sweep the ground; the branches of the inner rows are cut away to a considerable hight; there are long, quiet aisles disturbed by no storms, not dissimilar to the interior of a vast cathedral. The forest trees are trimmed up that the trunks may become more serviceable for timber and lumber; and worthless underbrush is cut away that valuable sorts may have a chance to grow, and they, too, are trimmed that they may become shapely trees, all of which presents a specimen of forest culture worthy of imitation. I noticed that the two barns had become insufficient. Ever from the New Testament days, thrifty farming has been indicated by the barns being found too small, and I think that this fact indicates the kind of farming on this place full as well as facts in greater detail could. The cattle are fed on corn stalks, hay, and oat straw cut by horse power, to which meal of oats, peas, and corn in the ear, wet with water, is added. The horse-power is also used to thrash grain and to saw wood, which fitted for the stove, is piled up under shelter. The yield from the orchard this year was fifty barrels of Russets, fifty barrels of Greenings, Baldwins, &c., and seventy-five barrels of cider apples. The yield of common oats was about thirty bushels to the acre. Three pecks of Norway oats were sown on new land of the marsh, and the product was forty-five bushels, averaging thirty-five pounds to the bushel. Considering that almost all the work is done in the absence of the proprietor,

when much must be ill-directed, I would say that the farm has been brought into good order, and that under the present system of culture it can be made to pay.

CONDITION OF CREAM FOR MAKING GOOD BUTTER.

Mrs. L. J. Trask, Muscatine, Iowa.—Has anybody ever heard that sweet cream will make insipid butter, or that it will be inferior to that made from sour cream?

Prof. J. A. Whitney.—When cream perfectly sweet is churned, the butter globules are broken by mechanical action alone, and the product is apt to be mashed or greasy, the grain being destroyed. When the cream is slightly soured the lactic acid helps chemically to weaken the caseine coverings of the globules. The butter comes more quickly, and all other things being equal, it is better to have the cream somewhat sour.

Mr. J. B. Lyman.—When I visited the famous butter dairies of Pennsylvania, I found that the owners were particular to keep the milk and cream in cold water, and, in skimming, I learned it was the practice to leave no milk with the cream. They use a skimmer with very small holes, as fine as a sieve, and put no milk into the cream-pot; but, when the milk is set, they put a little sour milk into the pan. This addition of a little sour milk does not affect the taste of the cream, yet the acid eats the surface of the little globules of caseine which inclose the butter, so they have no difficulty in churning. One gentleman assured me that scarcely a single spoonful of milk went into his churn with the cream; but this was in July. Their winter treatment is somewhat different.

Dr. Isaac P. Trimble.—I judge butter by the price it brings. The Philadelphia brings at least one-third more than the best product of other sections, that is from seventy cents to one dollar per pound. In Chester and Delaware counties, where most of it is made, they use spring-houses, placed over running streams of water, and the pans are set in and kept at a uniform temperature.

Prof. J. A. Whitney.—Experiments were made many years ago in the dairy districts of England, which proved that five per cent more butter was obtained when the milk was churned than when the cream only was churned. It is a settled chemical principle that butter comes more uniformly and in a shorter time when the milk is allowed to sour.

Dr. J. V. C. Smith.—This discussion brings to my mind a visit

I made to the regions famous for the Philadelphia butter, and I can bear witness to its excellence, and to the great neatness with which all its processes were carried on. But, as a curious commentary on the system of cold spring-houses, I may remark that I have seen butter made beneath a torrid sun by jerking the milk back and forward in a goat skin hung between two sticks. As I remember it, the quality was equal to that sold in the Quaker City.

Grasses.

George W. Hammond, M. D., Bennett's Corners, N. Y.—Allow me to say that your correspondent, R. P. Phelps, of Milford, Del., is right in his statement that there is no difference between "Herd's grass" and "Timothy" except in name. I was born and reared upon a farm in New Hampshire, and have known "Herd's grass" by name and sight for more than sixty years, as it has always been called throughout the New England States. It has always been said, and so stated by agricultural writers, to have received its name "Herd's" from first attracting notice upon the farm of a Mr. Herd, an early settler of Portsmouth, N. H. It is less than fifty years since I first heard the name "Timothy" applied to the same grass. In 1866 I removed to Madison county, N. Y., and are, as I always have been, much engaged in farming, and here I find the farmers and seedsmen know the same grass by both names. Herd's grass has not, as stated by Mr. Meeker and Mr. Lyman, "a reddish, bushy head," but the head is "round, small and firm," as it is described under that name in "Gray's Botany," with the botanical name, "*Phleum Pratense*," or Cat's Tail grass, I am aware that the "*Agrostis Vulgaris*," of Gray, or "Red Top," has been erroneously called Herd's grass in some portions of Pennsylvania, but never in New England or New York can the "Red Top" seed be obtained under that name.

Dried Fruits for Market.

Mr. C. H. Shipman, of Culpepper Court House, Va.—In the vicinity of their home there are strawberries, raspberries, blackberries, and the like, growing abundantly in the fields, and free for the picking. Would it pay to gather and dry them for the city?

The Chairman.—It is scarcely possible to overstock the market, provided the fruit be well put up. The demand is usually, I believe, greater than the supply, and our friend would doubtless find the proposed employment profitable, even if the prices obtained were much lower than those which now prevail.

DRAINING TILE.

Thomas Jackson, of Philadelphia, has four stout boys, is laudably ambitious to get them into the country, and to go himself; knows how to make tile for drainage, and came to the Club for information as to a good location.

Mr. John Crane.—I should think it might be worth while for him to look about in the vicinity of Woodbridge, New Jersey. The clay there is, I believe, abundant and of the proper quality.

Mr. J. B. Lyman.—The last point is an important one. There has been much complaint that the tile sold by some companies crumbles after being in the ground eight or nine years, and some becomes useless even sooner than the time mentioned. A person who engages in the business had better do the fair thing, and to avoid mistakes he must select clay that will make firm tile of bright red color, and that rings when you knock against it. There are many places in the middle belt of New Jersey where the best of clay can be found.

Adjourned.

December 16, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

DWARF AND STANDARD PEARS.

Mr. J. A. Newton, Brownville, Ind., asked three questions: Can dwarf pears be converted into standards by planting rather deep and hilling earth around the stem? How far should the trees be planted apart? Is it best to top low or encourage the growth of one long, straight stem?

The Chairman.—When I was younger by eighteen or twenty years I set some seventy-five dwarf pear trees, some of which were grafted close to the ground, and hilled up in the fall on account of frost. This brought new shoots, and most of them are now standards.

The Secretary.—I have had similar experience.

Dr. Isaac P. Trimble.—So have I, and so I suppose have many others, but I am of the impression that only certain varieties are thus affected.

Mr. A. S. Fuller.—The result will be the same with any and all varieties, provided the junction of the pear stock upon the quince root be made four inches or so below the surface. I may remark here that it is a good practice to remove the earth and cut several gashes at

the swell of the graft, then replace the soil, and new roots will come out on all sides, and the tree is therefore less liable to be upset by heavy winds. It may be remembered, as a rule, that by putting four inches of soil over the junction we change the dwarf to a standard, but if the dirt is only an inch or so in depth, the result will not be certain.

Mr. P. T. Quinn.—In reply to the question about distance I would say that twelve by sixteen feet is, I find by long experience, the best interval for pear trees. Being thus near, they protect themselves to a certain extent. As regards the concluding question, I adopt the practice of having the fruit as near the ground as it can be well induced to grow. I prune to a cone or Lombardy poplar shape so as to get a slim, tapering tree with fruit near the stem, and near the ground. The only objection to this style of pruning is that you cannot use your pear orchard as a pasture. But that is seldom desirable. If the trees are twelve by sixteen they will tax the ground heavily enough without requiring it to grow grass. My success has come from four practices; rich manuring, close planting, open top pruning, and mulching.

Cows Eating Bones.

Mr. I. Marlow, Chester, Vt., has cows that show a special fancy for chewing bones, and asks: 1st. "What is the probable cause of this morbid appetite?" and, 2d. "Will bone-meal fed to them, mixed with shorts, do any good?"

Mr. F. D. Curtis.—My cows have always been addicted to the practice of chewing bones, just as other animals chew opium and tobacco. It is thought by some that bone-dust increases the flow of milk, and a firm in Utica have lately established a mill for putting bones in a proper condition for mixing with other feed.

Mr. P. T. Quinn.—In course of a recent conversation with Prof. Cook, this subject come up, and he spoke of having lately met a gentleman from one of the dairy districts of England, from whom he learned that hogs fed solely on whey were quite unable to stand for want of sufficient strength of bone. This fact would seem to show that there is a demand in the nature of animals for the material in question. I have noticed that this taste for bone shows itself mainly in New England and New York, on old land, and especially on pastures that have never been manured. It proves the want of phosphate in the grass, it having been exhausted by generations of dairy farm-

ers who sold everything and returned nothing. Mr. Marlow ought to buy some bone-meal and feed it to his stock, and if he will buy more and sow it on their pastures they will get it in the way nature intended, and return the worth of it, and more too, in the richness of their milk or in flesh.

Trees for Fence Posts.

Mr. S. S. Gregory, Berea, Ohio, inquires concerning the Lombardy poplar as a fence tree, and adds: A neighbor of mine has a hedge of these trees, set out three years ago last spring. They are about six inches apart, and many of them over ten feet high. He thinks they will form a fence quicker than the Osage orange. The question with me is will they, when growing so thick, be sufficiently long-lived to make them worth while to use them for hedges. Very few trees can be propagated from cuttings better than this kind of poplar; and as they have a rapid growth, I have thought that, were they to be set twenty, thirty, forty or more feet apart, and one-quarter inch iron rod stretched from one tree to another, the rod and trees might serve as a cheap and good support for a fence.

Mr. D. B. Bruen.—I have seen fences made of rails mortised in these trees, but the plan is not a good one. If the trees live a year they live longer than they ought to live, because they are great exhausters of the soil:

Mr. A. S. Fuller.—I fail to appreciate the sense of growing these trees, which are at best, cheap and coarse, when maples can be produced as easily and cheaply. Let him gather maple seeds, sow them, and when the little trees are a foot or so high, transplant them to the hedge-row.

Prof. J. A. Nash.—And for hedging purposes willow is to be preferred.

ON THE PRODUCTION OF TEA AS APPLICABLE TO CALIFORNIA.

Mr. H. A. Shipp, read the following paper:

[In the composition of this article, I have endeavored to delineate in as brief and succinct a manner as possible, the experiences gained during many years residence in tea-growing districts of China, India and Burmah, as manager and proprietor of large tea estates, and have much pleasure in sending it forth for the benefit of the public.]

Introductory Notice of Tea.

Tea, the now universal beverage of the civilized world, and which will ultimately be the object of much attention to the States of California and Oregon, was but little known in Europe or America until the beginning of the seventeenth century, when it was carried into Europe by the Dutch East India Company, and is reported to have been introduced into England about the year 1666.

The tea plant has been discovered indigenous in China, between twenty-three and thirty-three degrees of north latitude; in Burmah, between twenty-one and twenty-seven degrees north latitude; Assam (India), between twenty-six and twenty-nine degrees north latitude; and in China, between twenty-three and twenty-six degrees north latitude. Tea was first introduced into the Himalayas by the English East India Company, in 1848, under the superintendence of Dr. Jamieson, and an able gentleman (Mr. Fortune), was commissioned to travel through the tea growing districts of China, and through his instrumentality the China tea seed, so jealously guarded hitherto by the Chinese authorities, was introduced into British India, and the information necessary for the cultivation and manufacture of tea, was also learnt by that gentleman; and later in the day, some Chinese tea makers were imported to instruct in its manipulation, which up to that period was known only to the Chinese and Japanese.

The extension of tea cultivation in India, promised at one time to bid fair as one of its principal productions; but like most Indian enterprises (indigo to wit), it has fallen into the hands of a few only, and owing to the very oppressive labor laws in that country, can never, as long as they exist, be considered a remunerative speculation. Under the regimen of the late Lord Canning, Governor-General of India, and the liberal land rules promulgated by him, the European and American settlers had an opportunity of opening out the resources of that country; but, as I said before, *that* is a thing of the past. On the face of this, let America ask herself if she cannot grow tea to compete with China? Has she no territory between the before mentioned parallels? If she has, why should a voyage of from eighteen to twenty thousand miles be necessary to secure tea for the whole civilized world, when the Pacific railroad would bring up the young crops to market, in from ten to fourteen days, and in a few years cut the throat, as it were, of all China.

VARIETIES OF TEA.

The several varieties of tea, known under divers names, are derived from the leaves of two species of the same shrub called by botanists *thea chinensis* and *thea verides* which belong to the family of the camelias, and bear to them a strong and marked resemblance. The teas of commerce are of two kinds, namely, *green tea* and *black tea*, which are both produced from the leaves of the same plant, differing only in age and manipulation. To the *green* varieties belong, Twankay, Hyson, Imperial and Gunpowder; and to the *black*, Pekoe, Louchoug, numbers one, two and three, Cougon and Bohea. There are certain requirements in the cultivation and manufacture of tea, without which success can never be attained. They may be briefly enumerated as (1st), the suitability of the site selected for the plantation; (2d), its proximity to water or other carriage; (3d), labor; (4th), the experience theoretical and practical of the manager; and (5th), a sufficiency of capital.

Having premised thus much, I now take up the subject as to how can California be considered as a tea growing country. Between the parallels of twenty-six degrees north latitude and forty-six degrees north latitude, lies that beautiful country containing thousands upon thousands of acres of the best soil, so well adapted to the growth of tea. The spurs of the ranges above and around the beautiful city of Sacramento, the banks of the numerous rivulets which feed the river that flows through that city; nothing could possibly be better for tea plantations.

It would be superfluous to describe the different parts of California geographically or topographically; it will suffice to say, that from the southern parts of California to its western boundary, and into the foot of the Nevada ranges of mountains, and the lower ranges of hills branching off them, or wherever the land has a sufficient natural drainage, and is above the possibility of floods, there is, except in the rocky localities, the land requisite for tea plantations.

The sites and soil described in this article abound on the banks of the river Colorado, and all the land between the coast ranges to the Sierra Nevada is full of such; the banks of the river Sacramento are also identical, and even in the territory north of California, stretching into the State of Oregon, there is land sufficient to grow tea for the whole world.

The fitness of the soil, temperature and climate of California having been satisfactorily shown, I would now offer a few remarks as to

the advantages which would accrue to it should the enterprising capitalists of the United States take up the matter seriously.

The Tea Plant Introduced by the Chinese into California.

The Chinese have lately introduced 3,000,000 of tea plants and quantities of tea seeds into the State of California; a fact plainly showing that both the temperature and soil are adapted to tea cultivation. The Japanese, still later, have imported many hundreds of pounds of tea seeds, thereby indorsing the Chinaman's views on the subject, and strengthening the proof, if such were required, that tea planting will one day not far distant be one of the principal and most lucrative agricultural pursuits of that State. Now, bearing in mind that neither the Chinese nor Japanese are mere experimentalists, but that they act upon a sure and firm basis, and that the growth of tea in California may be considered an established fact, or *they* would not venture as pioneers in such an undertaking, *we* may safely consider tea planting a sure and profitable investment, and one which will ere long attract the attention of our enterprising capitalists.

Inducements held out to Capitalists.

The cultivation of tea is, though four years have to elapse ere the true profits show themselves, one of the most paying speculations that can possibly be conceived; as on the fifth and succeeding years there will be, if properly managed, a return of cent per cent on the paid up capital. The benefit which the State will ultimately derive, by the introduction of a trade so fraught with beneficial effects, on the agricultural as well as on the mercantile portion of the community, must soon become apparent to the most superficial observer; the introduction of so many people, as would naturally follow such a step as the establishment of joint stock tea companies, would, in itself, be a blessing to so young a State as California; the increase and stimulus given to all other trades in consequence speaks loudly and clearly. Just look at the following figures, and then see if the scheme is feasible or not. There are more than 1,000,000 of acres fit for tea, and at the end of, say ten years, this could be brought under cultivation; this would introduce a capital of $200,-000,000, which would return, with ordinary success, 400,000,000 lbs. of tea, which, taken at the low figure of half a dollar per pound for *all* teas, coarse and fine, would, without the introduction of machinery, yield $200,000,000, and would supply the whole of Europe, as well

as America, with tea of a better quality than China produces; for it is a well known fact that the Chinese adulterate and color the teas exported, and not unfrequently have they been once used and then doctored up for the home markets.

The quality and quantity, herein stated, can be nearly doubled if the land be brought under a *high* state of cultivation; and if machinery, now invented, be brought into use, the manufacturing charges could be reduced one-half. This, then, is convincing proof that America ought to be one day the greatest tea-producing country in the world.

Inducement to Immigration.

Once the tea plantations are established in the State of California, there will be an inducement to the surplus population of the old world to emigrate at a far greater rate than they do now. It takes one man to two acres, and that alone to produce the tea; there would, therefore, be 500,000 men, women and children as an immediate increase of population, the transit, increase of railway traffic and river boats, besides the necessary augmentation of the agricultural portion of the community to grow food for the former; altogether it would be the cause of an addition of 1,000,000 to the population; and labor is at all times, to a new country like California, wealth.

Introduction of Chinese.

In China there are hundreds of able-bodied men who would be glad to avail themselves of the opportunity to quit their land of oppression, and take service on the shores of California, more especially with the prospect of getting such work as the growth and manufacture of tea. They could be engaged for a term of from three to five years, and would be valuable men, much more so than any other class, for the manufacturing department. Strong, healthy men would be required for *hoeing* and *plowing*, and women and children for the plucking of leaf. The Chinese are a race of clever, ingenious people, and, if treated well, are good servants, especially when under the laws of a country like the United States, which recognizes all men as entitled to an equality before its tribunals of justice.

The Permanent Laborer.

This class should, if possible, be looked upon as part of the great family; that is, they should be housed and fed at the expense of the

estate, and engaged for a term of not less than five years. Families containing from two to three children are the most desirable, as the children are of more use than the adults at *plucking* leaf, and women next. The adult males may find plenty of employment as enumerated further on in these pages.

Casual Laborers.

Casual laborers could find work in plenty in the dry season, after the plucking season is over, in brick-making, hoeing, burning charcoal, cutting fire-wood, &c., &c., but they ought never to be employed in any of the following works, viz.: *Pruning*, *plucking*, *rolling*, *roasting* or *packing* teas, as this is the work of those who by practice become adepts, and can be trusted when not under the immediate supervision of the manager or his subordinates.

Water Power.

As California abounds with water powers, there would be but little use for steam, as the *rolling by machinery* would require but small power for a large factory, and most of the power could be used up by diverting it to saw-mills, for cutting up box timber, as also for the working of dovetailing machines and irrigation. The paper used for covering the boxes ought to be sufficiently strong to hold the boxes together under any usage, and could be made at but little cost on the estates, from bark or coarse fibre, such as the "esparto grass" or oak bark. Covering the boxes with gunny bags is quite superfluous, unless for the choicest teas, which should never be packed in large boxes, but in half chests, containing about thirty-five pounds.

Russian Brick Tea.

The choicest teas sent to Russia are made up into bricks of about six pounds weight, and are done up in this manner to preserve the flavor, as much as for easy transit across the mountains and through Thibet. If this mode of manufacture were once introduced into America, there would be less expense attending the packing, and a better description of tea drank; for it stands to reason that teas confined by pressure into the form of a brick, must preserve their flavor and aroma better than loosely packed teas.

Selection of Site, Soil and Climate.

First—Site.—The best site for a tea garden or plantation is that commanding water carriage, or that is in good communication with

railways, with a good flat or undulating lay of land, sufficiently elevated to give a natural drainage, and carefully avoiding all steep localities, which are liable to landslips and difficult of cultivation, though it is desirable to be as near a range of hills as possible, both to secure a sufficient rain fall during the season of drought and to be sheltered from the north-westerly gales, which are frequently accompanied by hail storms, and entail considerable damage to the tea plants. The proximity of water is advantageous for easy irrigation of the nurseries, as well as of the young plants during their first years' growth, in case of drought, and for the ready transport of manufactured teas, supplies, fuel, &c., &c.

Second—Soil.—The soil most preferable is a light, friable, filtry, ferruginous clay, free from stones, slate or boulders of rock, which prevent the tap-roots from penetrating to a proper depth to sustain the plant in a healthy condition, or of attaining its full vigor, and are very often the means of totally destroying them. A reddish loam, with a depth of one to one and a half feet, and a subsoil somewhat retentive of moisture, is also a desirable one; but the more iron there is in the soil the better the qualities of the teas grown thereon.

Third—Climate.—The climate in which tea has been known to thrive best, is one in which periodical rains occur, and where the heat is not so intense as to check the full development of the plant, or a temperature ranging from 20° Far. to 100°. Though tea grows at an altitude of 8,000 feet, and is of a full rich flavor, yet its growth is so slow that it would never pay, as a mercantile speculation, to cultivate at that height. The limit as to altitude should be from 2,000 to 4,000 feet above the level of the sea.

CLEARANCES: TREES TO BE RETAINED FOR SHADE OR PROTECTION IN EXPOSED LOCALITIES FOR BOXES, FUEL, &C., &C.

First—Clearances.—In commencing clearances, the first and most important measure is to clear a sufficient space for a commodious, though temporary, homestead or station, as well as to cut down and burn off all the surrounding growth, whether grass, brushwood or timber, to a distance of 300 yards, in order to prevent the possibility of any after destruction of the buildings by fire, either accidental or designed.

Second—Plantation.—The clearances for the plantation should be governed by the *description* of *seed* used, and manner in which it is sown. *Hybrid* and *China* seeds may be sown at the stake or from

nurseries. If the former mode be pursued, the whole of the forest and underwood should be cut down, with the exception of such timber as might be desirable to retain for building or other purposes. If the latter, small trees should be left as a temporary shade, especially on the western side, so as to protect the young transplants from the fierce heat of the afternoon sun.

Indigenous seed ought always to be sown in nurseries, as it produces a very tender plant, and is most delicate, and should never be removed until the second season, when it should be planted out under light shade, and which ought not to be cut down till the following year.

Third—Trees to be Retained for Protection in Exposed Localities.—It has been suggested to retain for shade during the first two years all trees that may be made useful on the estate; but if the land to be cleared be grass, and not tree forest, any quick growing trees may be advantageously planted, at distances varying (according to extent of their foliage) from fifteen to twenty feet apart, at the discretion of the planter; but in the third year all shade should be removed, as it is most essential to the health and vigor of the plant that it should have both light and air.

Fourth—Trees for Boxes.—The best woods for boxes are those which are light, and contain no resinous properties, or such trees as may be quickly raised.

Fifth—Trees for Fuel, Charcoal.—The pine tree, spruce tree, and many other indigenous to California, are fit for fuel, and for charcoal. None are better than the oak, which abounds, and native red wood.

The Laying Out of a Plantation.

In laying out a plantation, the first thing to be done (after plowing or hoeing) is to line and stake off roads, twelve to fifteen feet in breadth for the *main*, six for the crossroads.

The crossroads should divide the garden or plantation into measured patches, and these patches should be numbered, so that contractors may have no difficulty in undertaking the required area. A register book should be kept of these patches in the following way, for future reference, viz.:

Example.

No. of Plantation.	Area.	Contractor's name.	Nature of contract.	Amount Paid.		Age.	Yield.	Average per acre.	Remarks.
				Dols.	Cts.				
21	10 acres.	Smith.........	Hoed ...	20	00	3	400 lbs...	40 lbs...	

After which, lines for the plants should be marked out at right angles to the roads, as much as possible, both for economy of labor in planting out, as for the subsequent appearance of the garden. These lines should be crossed transversely at a distance of five feet apart for China variety, and for hybrid and indigenous, five and a half to six feet; and at the intersection of each crossing, a good stake, three feet high, should be driven firmly into the ground to mark where the seed or seedlings should be placed. Fruit and ornamental trees may afterward be planted along the sides of the roads, in such a way as not to interfere with the growth or cultivation of the tea plant, while the effect on the garden would be enhanced.

Factory Buildings.

The residence of the manager and principal factory buildings, as warehouse, factory, packinghouse, &c., should be in as central and elevated a position as possible, for the sake of the health, the readier supervision of all persons on the estate, and the equalization of the distance from the remoter parts of the garden.

Laborers' Houses.

Resident laborers' houses should be built at a considerable distance from the factory buildings, in fact, on the outskirts of the plantation, so as to insure against fires, or disease from overcrowding their houses; should be surrounded by fruit and vegetable gardens, as much for the purpose of arresting malarious diseases, as for the comfort and health of the laborer.

As it is absolutely impossible to depend on casual labor for the manufacture of tea; the factory hands, at least, should be located on the plantation; but it will be found most advantageous to contract with as many men, women and children as may be required for at least three years after the plantation comes to its full bearing, as after one year's practice the hands become adepts in the various operations.

There is plenty of work during the dry season, in the shape of hoe-

ing, plowing, weeding, pruning, road making, bridge building, house repairing, wood sawing, charcoal burning, and many other important works of equal consequence, but too numerous to mention here. There should be good drainage, and no stable or manure of any kind allowed to be wasted, but all the latrines, stable pits, &c., drained into a close reservoir for future utilization on the plantation.

Good water is one of the most essential things in a tea garden, as it not unfrequently occurs that bad water is the cause of epidemic diseases, and such organic diseases as are not only detrimental to the laborers themselves, but are frequently felt by a loss sustained by the factory to more than ten times the cost of good wells, tanks, ground filters, &c., &c.

FACTORY AND STOREHOUSE

Should be entirely isolated from all other buildings, as should the storehouse, and they should each be surrounded by a ditch and wall, or a strong fence, for the purpose of keeping out trespassers and stray cattle. Both factory and storehouse should be built of iron or brick, and on no account should thatched or shingled houses be used. The ground round the factory must be kept clean and no grass allowed to grow, as the space is required for the withering of the leaf, for the purpose of making *black teas;* therefore it would be advisable to plant it out, at long distances, with fruit trees, or even with vegetables or flowers; it would cost but very little more than keeping it clear.

Before quitting this subject it may not be deemed superfluous to offer some suggestions as to the nature and number of the buildings required to be erected.

RESIDENCE OF MANAGER.

The residence and out offices of a manager, on first opening out the estate might be roughly and cheaply built, of materials procurable on the spot, as a frame house with shingle roof; care should always be taken that the flooring be raised above the ground, at least three or four feet, so as to avoid all chance of malaria, which is very prevalent in newly cleared forest. This house should be so substantially erected as to last till such time as every building on the estate ought to be made permanent, by being constructed of masonry, which would prove cheapest and best in the end, as no repairs would be needed and no risk run.

Storehouse

May be made of the same material as the preceding, will also be but a temporary building for the first three years, or until a good crop of tea may reasonably be expected, when it should, like the manager's residence, be built of masonry, and ought to be capacious and well ventilated, with an asphalte flooring, and corrugated iron or flat stone roof.

Factory.

This building will not be required till the third year, when it should be at once built of masonry, of a size suited to the estate or land under cultivation. One roasting pan is calculated to be sufficient for the manufacture of the produce of fifty acres, and should be set in the masonry at an angle of thirty-two degrees for *black*, and horizontally for *green tea.* This building should also contain two strong wooden tables running down its center, four feet broad and three feet high, so as to enable the tea makers to conveniently roll the leaf, unless tea rolling machines be used. The pans should be arranged across one end of the building, with flues carrying off the smoke, and four or five tiers of shelves should line the walls, for the purpose of storing the leaf as brought from the plantation. Between the tables and shelves two rows of brick-built fire-places should be erected at a distance of six feet from each other, for drying the tea.

Packing House.

The packing house should be a commodious building of masonry, for the purpose of containing large wooden *bins* lined with lead or zinc, capable of storing a thousand pounds of tea. They should be on trucks, and easily portable in cases of fire or other accidents. The object of these bins is to equalize the quality and flavor of the tea, by keeping each particular description separate until every arrangement has been made for its being packed and dispatched from the factory. This building ought also to contain a number of charcoal fire-places for finally drying the tea previous to packing. Every building in the factory should be erected with walls sufficiently thick and substantial to allow of a second story being added afterward, as the cultivation and yield of the estate increase, and additional accommodation becomes necessary.

Preparation of the Soil.

Immediately after the forest has been burnt the land should be hoed to a depth of eighteen inches, and all the roots carefully taken

out and piled in small heaps to dry, after which they also should be burnt prior to the second hoeing, when the soil must be well pulverized to enable the planter to transplant with greater ease and more security. If the undulations of the land permit, the plow and harrow might be substituted with advantage for the hoe on this second occasion, both as a matter of economy and expedition, but the land must, in the first instance, be carefully hoed and the roots extracted, as that could not be done with the plow. After the soil has been prepared as above described, a hole one foot deep and nine inches broad should be dug at each stake, for the reception of the transplant.

Sowing of the Seed.

The seed, immediately on arrival at the factory should be taken out of the bags or boxes in which received, and placed in damp beds six inches deep, which ought to have been carefully prepared beforehand for its reception. The mode of sowing the seed is by depositing a layer broadcast, as close as the seeds will lie, and sprinkling them with soil to the depth of an inch, to be again succeeded by a layer of seed and an inch of soil, until the bed be filled up, when the surface should be lightly watered and covered with mats, straw or grass, in order to protect the soil from the influence of the sun, which would heat the bed and cause the seed to germinate too quickly, while the object is merely to swell the seed, prior to permanently planting it at the stake, or transferring it to the nurseries.

Nurseries.

The time for forming nurseries is November, and these should be made on as level and low a site as possible, so as to be near water, care being taken that the soil be good and that it be well turned up to a depth of two feet, thoroughly pulverized, every root and stump extracted and formed into raised beds, five feet in breadth, with the space of two feet between each bed to give a passage for watering the nurseries; the earth taken therefrom being thrown on the beds, to raise them to a height of six inches to prevent inundation in the event of any heavy fall of rain. The sides of the bed must be hardened by beating so that they may not be easily washed away or trodden down. Should the beds be inconveniently long, cross paths might be made at intervals, to allow of a greater facility in watering and tending them. The whole should be fenced round to protect them from cattle or wild animals and watchmen must be kept up

night and day to drive off squirrels and other destructive animals as rats, porcupines, etc.

MODE OF SOWING HYBRID AND CHINA TEA SEED.

If the seed be Hybrid or China and it be intended to transplant it, during the first season, it should be sown in rows four inches apart, with a space of two inches between each seed; but if the seed be indigenous it should be sown five inches apart each way, which will allow of the removal of plants without injury to the roots during the second season. Great care must be taken not to sow the seed deeper than one inch or one inch and a half, as that depth is quite sufficient for all purposes. Immediately after the seed has been sown, it should be watered and thickly covered over with straw so as to retain the moisture and protect the beds from the sun's rays, nor need it again be watered till the plants spring up, when the staw may be thinned and the plants daily watered. No weeds should be permitted at any time, and constant care and attention must be bestowed on the seedlings till they attain sufficient strength to render further anxiety unnecessary. Recent experience has proved that the erection of artificial shade as formerly practiced is not needed, but, on the contrary, is highly deleterious to the young plant by rendering it too delicate and subjecting it, on removal of the shade, to too sudden a change, while early exposure to the sun renders it hardy; light and air being essentially necessary to its well being.

Should the young seedlings be attacked by caterpillars, ants or other small insects, they may be speedily exterminated by turning a few domestic fowls into the nursery, as from close observation it has been proved that they do no injury to the growing plants.

TRANSPLANTING.

Transplanting should never be attempted until the rains have fairly set in; and even then the indications of the weather must be carefully watched, least any break should occur, as a few days drouth would at this particular time scorch up and kill the plants. The best day for transplanting is that on which a drizzling rain is falling, or even a dull cloudy day, with the prospect of further rain, may answer; but if the seedlings have been removed from the nursery and a change should take place in the weather it would be better to put them into a *dark* and cool room with earth round their roots than attempt to plant them out, and they have been known to

keep in this way for several days without sustaining the slightest injury.

In removing the seedlings from the nursery too much care cannot be taken, as the life and health of the plant entirely depend on the manner in which this is done. The best mode is to dig a trench at the end of the bed from which the seedlings are to be taken to twice the depth of the tap root, and then remove each row in succession with a circular spade or gouge, laying them in circular flat baskets with their roots to the center, covering these latter with earth to protect them from exposure.

On arrival at the place where they are to be planted, a hole sufficiently large to admit the tap root of the seedling should be made with a dibble in the hole already prepared, as before described under the head of *preparation of the soil*, which directed that "a hole one foot deep and nine inches broad should be dug at each stake for the reception of the tea plant."

The *dibble* used in this process, namely, in making a second and smaller hole within the first, should be eighteen inches long with a diameter of three inches tipped with steel or iron, and a chisel edge instead of a sharp point, as the latter is liable to create a vacuum under the end of the tap root, from the earth, unless well pulverized, being unable to reach down to the extreme end of the hole and thus causing the death of the plant; but this danger is obviated by the use of the dibble now suggested, as the hole can be made of the same size at the bottom as at the top by turning the dibble round two or three times which can easily be done by its cross handle as it gives a great purchase on the instrument.

In transplanting, the plant should be held in the hole by one hand and the earth finely crumbled in with the other, care being taken to press it down lightly round the seedling until firmly set. The object of digging the *first* hole to a depth of one foot as above described, is to prevent the lateral roots from being too near the surface when the plant arrives at maturity, which would render them liable to be cut and injured while hoeing; whereas, by adopting the plan herein recommended, the hole will, in the course of the first rainy season, gradually and naturally fill up, by which the health of the plant will be secured.

Hoeing, Plowing and Weeding.

Hoeing should be constantly (say once in every two months), performed to a depth of at least eighteen inches, and, on each subsequent

occasion to *transplanting* (prior to which two hoeings have been directed), the earth should be turned over in large clods with the roots of the weeds exposed; as they will thus die more rapidly, and return to the soil, by being left on it all the nourishment they have extracted from it.

If the above practice be followed, there will be little occasion for weeding, but should such a necessity arise, it ought to be performed by the hand, or with the weed-cutter, and all the weeds taken up should be either removed to a manure pit or buried between the lines as, by being left on the ground, they are liable to harbor insects, which would attack the tea plants.

It is very advisable to loosen the soil occasionally round the roots of the tea plants, so as to give a free admission of air and moisture; and for this purpose the hand-hoe is best adapted, as in the use of the regular hoe great danger is incurred of cutting the lateral roots of the young tea trees.

In all cases, where practicable from the lay of the land, plowing should be resorted in preference to hoeing, as being more economical, and the plants having been set out at right angles, the plow can be carried transversely throughout the garden, and most effectually perform the work required.

PRUNING.

This is a matter on which much discussion has arisen, and much diversity of opinion, as on the successful result of it mainly depend the luxuriance of yield of the tea crop, and the ultimate welfare of the plantation.

In the *first* year, it is sufficient to *top* the plant, which is done by nipping off the upper green stem with the forefinger and thumb, as this arrests its upward, and promotes its lateral growth.

In the *second* year the plant ought to be cut down to a height of twenty-one to twenty-four inches, and all the small lower branches stripped off to eight inches above the ground by *breaking*, not *cutting*, them, which will prevent their again shooting forth. Much depends on the care with which this is done, as, if neglected or carelessly performed, the danger to the plant of affecting it in the succeeding year will be increased; while a free circulation of air, given at this critical time, greatly benefits the tea tree, and the removal of all branches to a height of eight inches from the ground, lessens the liability of the plant being attacked and destroyed by

insects, which must result if the branches be allowed to trail on the ground, and dirt to accumulate round the stem.

In the *third* year the pruning should be performed by *trimming* with the *knife* in preference to the *shears*, which, unless used by those who thoroughly understand them, only break and jag the plant so as to give the lateral branches an upward tendency. All straggling branches should be closely trimmed and a conical form given to the plant.

In the *fourth* year the branches should be neatly trimmed round the sides or the plant, and cut down to from twenty-four to twenty-six inches in a flat, table-like shape, the secondary laterals being thinned out from the center, if the plant be not sufficiently ventilated; as too dense a growth in the heart is highly injurious, care being at the same time taken to remove all the cuttings from off the plant.

In the *fifth* year much the same system may be pursued, with the exception of the pruning being made more concave toward the center, allowing three inches below the margin of the bush.

In the *sixth*, and succeeding years, the planter must be guided by the requirements of the tea tree, and must exercise his own discretion, bearing in mind that, by cutting all old wood, he promotes the growth and development of new shoots, which are essentially required for manufacturing purposes.

Insects Injurious to the Tea Plant, and best Preventive Measures against them.

The most destructive of all insects to the tea plant, and particularly to the seedlings, is the *paddle-cricket*, which burrows itself to a great depth during the day and makes its raids on the plant at night, nipping them off close to the ground, and destroying in this manner thousands of seedlings in one night. There are only two methods of destroying these insects, namely, by either digging them out of their holes, or by inserting poison (cyanide of potassium) therein and closing up the orifice with a stake firmly driven down it.

Caterpillars, bugs, ants, and various descriptions of the beetle tribe are also somewhat injurious, especially the white ant, but not to such a degree as the paddle-cricket; and the only mode of guarding against them is by keeping the plantation perfectly clean and the plants free from dead wood.

There is also a *weevil* called the *borer*, which has been found to destroy the tea plant, by piercing the stem and boring a complete

circle round it just at its junction with the surface of the soil. A plant attacked by this insect shows signs of sickness by drooping and by its leaves turning yellow, when an application of lime and water, or whitewash, round the stem at its base, may occasionally recover it by killing the insect and thus removing the cause of the plants decay; but if not taken early in hand the certain death of the plant must ensue.

PLUCKING THE LEAF.

The plucking season commences about the end of April and continues till the end of October, during which time a series of flushes occur at intervals of twelve or fifteen days, according to the weather, and thus twelve crops of leaf may be gathered in one season. The plant should not be plucked before the third year, and then only very lightly, as over-plucking will render it weak and sickly. The yield from an acre planted at five feet apart should be 280 pounds of green leaf, or seventy pounds of manufactured tea in the third year; double that in the fourth, and quadruple that in the fifth year; though care and high cultivation will give even a much larger return, as both in Assam and Cachar, seven maunds, or 560 pounds of manufactured tea have been obtained from one acre.

The most advantageous method of plucking is to divide the *leaf-pluckers* into *three gangs*, in number according to the flush to be gathered, each gang to be supervised by an intelligent overseer. The "Pekoe" gang should be composed wholly of women and children, as their hands being more delicate are better adapted for nipping off the convoluted bud, and its two expanded leaves from which "Pekoe" is made. This gang should be followed by the "Souchong" pluckers, who gather the next two leaves, and they again succeeded by the coarse tea or "Cougon" gatherers. The object of this division of labor is to keep the leaves separate for the manufacture of each class of tea, when brought to the factory for manipulation. Another advantage gained by this careful classification of the raw leaf is that it prevents the coarser and harder leaves from breaking the leaves of the finer teas during the process of rolling; and furthermore, obviates the necessity of so much sifting as would be required if all the teas were manufactured together. One caution should be impressed on the last two gangs of gatherers, namely, that, in removing the leaves, they do not nip off the stem as well, but pluck upward, leaving about a quarter of an inch from the eye or bud for the reproduction of fresh

shoots. Each *leaf-plucker* should be furnished with a small basket, suspended from his neck by a band, into which he should throw the leaves as gathered, and, when filled, transfer them to a larger basket, which ought to be carried to the factory without delay, as exposure to the sun while in a large mass tends to heat and spoil them. All plucking should, if possible, be finished by noon, to permit of the manufacture of the leaf on the same day it is gathered, as it improves the quality of the tea both in respect to color and flavor.

Labor, Management of, Apportioning of Works, Payments and Advances.

Labor consists of two classes, local and imported, and each class requires a separate kind of treatment. The imported laborer is dependent on, and a part and parcel of the estate, until the expiring of the term of his contract, while the local laborer is a free agent and works when and where he likes. Imported labor is a medley of all classes, and the men are, in consequence, most difficult to manage at first. Some are of a lively disposition, others sullen and sulky; some are active and others lazy; some are contented, others again are discontented; some there are (but few) respectable, while there are others that would breed discontent wherever they went. However, it is the duty, as well as the interest of the planters, to treat all with kindness and consideration, and to endeavor to reconcile them to their new home on their arrival at his factory, and to make them understand that by justice, and justice only, between employer and employed, they are to be governed. Once establish a mutual confidence, and the imported laborer overcomes his repugnance to locate himself on the plantation.

The duties of the laborer are multifarious, and it would only be a recapitulation to enumerate and define them here, as the whole of the duties portrayed in this essay, are the works of the laborer. But the duties of the master to his laborer, are not so fully understood as they ought to be, so it may not be out of place to define them here as succinctly as possible. First, then, he must study the character of the individuals he has to deal with. Secondly, he must pay every attention to the sick, and keep up a regular supply of medicines and medical attendance. Thirdly, he should see that his laborers are supplied with good and wholesome food, and that they are not cheated in quantity or price. Fourthly, he must be careful that the water they drink be pure, as the health of his laborers chiefly depends

on this; for more disease is engendered by bad water than by anything else. Fifthly, he must see that his laborers are paid their just dues, and as soon after it is due as possible. If these suggestions be carried out, few laborers will care to desert their employers; but, on the contrary will, as has already occurred in many instances, reëngage after the expiring of the term of contract.

The laborers should be divided into gangs under the supervision of an overseer, and the ordinary work of the garden should be portioned off to each gang, at the rate of one man to two acres. This can easily be done, as the garden will have been divided off according to its natural formation. If the land be flat, each gang of twenty men could be allotted forty acres in one patch, numbered stakes being placed to mark its boundaries; but if the plantation be detached, the spaces so separated could be worked by the given number of men, according to the acreage, under one or more overseers.

A certain percentage ought always to be allowed for sick or absent men, out of a reserve gang kept for that purpose as supernumeraries. Each gang should be chosen as much as possible of one class, and located together in their own habitations. The factory hands should be kept on the factory, and have a somewhat higher rate of wages, as by this means they would be induced to be more watchful and careful in the performance of their various duties. Field labor, especially hoeing, unfits them for the delicate task of manipulating the leaf, and alternate exposure to the outer atmosphere and the heat of the factory frequently engenders disease. All the gangs should be numbered and mustered every morning, each laborer's name being called from the muster roll, and their daily task apportioned them, with instructions to each overseer. The work accomplished should be daily measured, whether in field or factory, and the laborers informed of the amount each had earned, which should be then and there written down by the clerk appointed for the purpose, who ought to be in charge and attached to every 200 men. Should any dispute arise, the work should be immediately measured in the presence of the laborer and the overseer in charge of his division, whose duty it is to supervise, under the orders of the person in charge, the whole of the division placed under his control. It would at all times be advisable to pay the laborers monthly, and as soon as convenient after the expiring of each month, as this regularity gives them confidence in their employer.

A savings bank system ought to be introduced into every factory,

and statements carefully kept of each man's account. Small advances might be made at any time during the month to laborers requiring to purchase cattle, or other articles needed by them to add to their comfort, as it is more than probable that, if comfortably settled, they will renew their agreements with their employer, a great desideratum to a factory, as new hands take a considerable initiation ere they become proficient. Advances for local labor might be safely made to such respectable persons who offered to procure laborers at the current rates of the district, such security as they could tender being accepted for the due fulfillment of their contract; or work might be measured off to them to be performed by their own employes at a certain fixed rate, to be paid to the contractor, he making his own arrangement with his work people.

The advance system, though deprecatory, is advantageous in this respect: That it attracts labor to the estate, and any loss that may be sustained in consequence of breach of contract is more than compensated by the additional labor attracted, to say nothing of the saving effected on the other hand, by not being obliged to import all the labor required.

Manufacture in all its Branches, with Suggestions for Machinery.

Mode of Manufacturing Black Tea.—The plucking of the leaf having been described in a preceding paragraph, need not here be again commented upon. On delivery of the leaf at the factory it is first weighed and then strewn thinly on the shelves, which line the walls of the tea house, for the purpose of cooling; when twenty pounds should be issued to each roller, who places it out in the sun to wither, beating and tossing it with his hands, and picking out all coarse and useless leaves. After the leaf is sufficiently withered, which can be ascertained by compressing a handful, if, on opening the hand, the leaf has lost its elasticity, it may be considered withered; it must be taken back into the tea house, *cooled*, and rolled on the tables in small portions, being formed into balls, until all the leaf has been rolled, when the first ball is again rolled and all obstinate and unrolled leaves picked out to be afterward mixed with the coarser teas. The leaf being now ready for the pans is transferred to them and the roasting process commences, the pans being kept at a temperature of 180 degrees. After being roasted for ten minutes, during which time the leaf must be constantly stirred and tossed

about, to equalize the roasting, and prevent its being burnt, it must be again rolled and placed in covered baskets to be a second time passed, for a quarter of an hour, through the roasting pans at a higher temperature, viz.: 212 degrees, when it must be kept stirred with two pieces of wood, the heat being to great for the hand. After being taken out of the pans, it is again rolled, while still hot, and spread out on mats to cool, when it is ready for the drying process, which is affected in trays or sieves, placed over the charcoal fire-places, and occupies a period of five or six hours, or until thoroughly dry, when it is dispatched to the packing house and classified into "*orange Pekoe*," *first* and second Souchong, and first and second Congon, by being passed through the winnowing machine and sieves, when it should be stored in the large bins already mentioned, until a sufficient quantity be prepared for packing. The refuse of the manufacture of the above teas is called "Bohea," and consists of all the coarse, brown and unrolled leaves, which have been hand picked. This tea is of little value for export, but may find a ready sale in the local markets.

"Flowery Pekoe" is manufactured quite different from the above teas, being submitted to neither the rolling nor the roasting processes. When the leaves to be plucked (as described in a preceding paragraph) from which this class of tea is made, are brought to the factory, they are thinly spread upon mats and exposed to the influence of the sun for twenty minutes, after which they are again cooled in the shade, and exposed to the sun in larger quantities, until the leaf has well shrivelled, when it is thinly sprinkled into flat sieves and placed over slow charcoal fires, being at the same time covered up to keep in the aroma. Prior to being finally packed, this tea must be placed to a depth of five or six inches in each sieve or tray and thoroughly dried, which takes about eight hours. The leaf having been carefully plucked in the garden (as advised) by the "Pekoe gang," requires neither winnowing, sifting, sorting, nor picking, but should be packed, while hot, as soon as it is ready, the flavor being thereby improved.

The manufacture of green tea is a very tedious and lengthy process, nor has it been much practiced out of China, but the following is a brief description of the mode in which it is performed by the Chinese tea-makers.

The young leaves are as soon as gathered, taken to the factory and immediately spread out to cool, which occupies some considerable time. They are then put into the horizontal pans and submit-

ted to a heat of 150 degrees until perfectly soft and pliable, being kept constantly stirred to prevent their adhering to the sides of the pan, after which they are quickly rolled and made up into balls, in the same manner as black tea, and exposed to the sun on mats to dry, the juice being expressed from time to time by the hand. This takes three hours and they are afterward transferred to the pans, where they are again heated and constantly stirred until the leaves become perfectly crisp and dry which will occupy several hours as it is necessary to bring out the required color by this *process.* The more juice that is extracted from the leaves, the better will be the color and flavor of the tea, and this might be more effectually done by machinery than by the hand. The tea being now ready for the packing house, is submitted to the same processes as before mentioned, in the case of black teas, and classified into Twankay, Hyson, Imperial and Gun-powder.

Chinese Mode of Coloring Green Tea.—The apparently beautiful bloom which purchasers of *good* green tea are so persistent in having, and tea dealers so loudly put forth as being proof of the freshness of the crop, and indicative of the pureness and high quality of the article, would not be so much sought after, were it fully understood what all that beautiful bloom means, or how it is produced; and for the satisfaction of our tea-drinking friends, I will here describe the process of "raising the bloom." After the green tea (which is more yellow than green), is manufactured, it is not, according to present taste, fit for the market, so must be made so; this is effected by the tea in question being damped by steaming it, and when thoroughly saturated, a mixture of gypsum, turmeric and indigo, is made up and added in the proportion of one pound to forty pounds of tea; and this composition, together with the tea, is placed in a revolving cylinder which is driven at great speed for some minutes, after which the colored tea is taken out and dried over fierce charcoal fires. This is the mystery of the "beautiful bloom."

The present mode of manufacturing tea is no doubt a very primitive one, and one that is capable of vast and important improvements; especially in the rolling, roasting and drying processes, which might be advantageously performed by the application of steam or heated air.

Box-making, Packing, Leading, Stamping and Shipping.

Box-making.—For the purpose of box-making, light, seasoned timber is requisite, and as the boxes should be made of equal weight,

it would be advisable to have them constructed by machinery. Saw and dovetailing mills could be erected for a comparatively small outlay, and could be made a source of profit by supplying adjoining estates with boxes. They are indispensable on a large property, where the wood is at hand and the requirements are great, as the same steam power would be available for other factory purposes.

Packing requires much care and attention, as if negligently done the tea is liable to be injured. After the tea has been finally dried it should be put into the lead-lined wooden boxes previously prepared for its reception; the lining having been carefully examined to see that there are no holes in it.

The tea should be shaken down into the box so as to make it pack tight, but on no account should it be pressed down, as that would crush the tea, and thereby detract from its market value. After the tea has been soldered up, the lid of the box should be *screwed* on, not *nailed*, as the nails are liable to penetrate the lead, and injure the tea by admitting the air. The box may now be weighed, entered in the factory book, marked and sent to the storehouse.

The lead is soldered on a mould, the exact size of the interior of a tea chest, after which the box is carefully placed over the mould, turned over, and the mould cautiously removed, when the box is lead-lined and ready for the reception of tea.

Stamping is at present done by stencilling or painting over a perforated metallic plate, the required letters and numbers, defining the name of the factory, where produced, number, and class of tea; all of which particulars are, with the date, entered in the factory book, and accompany the boxes when dispatched, in the form of an invoice.

In shipping teas by boat from the factory to the port of export, care should be taken to thicken the boat at the bottom with light wood ten inches high, and at the sides five inches, to prevent any damage from water. The roof of the boats ought to be well covered in with tarpaulins, so as to be perfectly water-tight. But it is always better, where practicable, to dispatch teas, which are so valuable and perishable a cargo, by steamer or rail.

Seed, Plucking, Drying, Packing, Transport—Best Mode of Preserving—Application to Economic Purposes when not Salable.

There are three descriptions of seed, namely, indigenous, hybrid and China, but all require the same treatment, as they are all equally of a perishable nature.

The time for seed-plucking is in the months of October and November, when the seed is thoroughly ripe, which is known by the brown appearance of the capsules. There are many seeds that never ripen on the tree from the sun not being able to penetrate to them, and these should be left to the last.

After gathering the seed it should be placed on airy shelves or platforms, in a cool shady place, until the capsules open, when it can be shelled by the hand. On no account should seed be exposed to the sun, as it causes fermentation, and its consequent destruction. After being shelled, the seed should be left on platforms exposed to the air, to enable it to dry, being turned over night and morning for five days, when it may be packed in perforated boxes or gunnybags, with small pieces of charcoal, the same size as the seed, and to half its bulk. Seed packed in this manner will keep for three months, as the charcoal will absorb all the moisture given off by the seeds, and thereby prevent decomposition.

Tea seed ought to be transported with as much expedition as possible, since it is very delicate and liable to damage. Whether dispatched by boat or steamer it ought to be turned over every other day for the purpose of being aired.

The best mode of preserving tea seed, if intended for dispatch to any distance, is packing in charcoal, as described above; but should it be required for planting on the estate where produced, no better method can be adopted than that already advised of depositing it in damp beds until required for use, as it has been known to keep quite fresh in this manner for several weeks, and even should it swell and germinate a little, extra care in its removal is all that is required.

The oil expressed from tea seed is fit for all factory purposes, and would no doubt become an article of commerce, if procurable in any quantity, though its relative value cannot be estimated, as no export of it has yet taken place. The refuse might be advantageously applied as a manure placed in small quantities round the roots of the tea plants, as it would return to the soil many of the properties originally extracted from it. The oil cake might also be found useful for cattle, as the ripe nut is greedily devoured by deer and wild pigs, which leads to the inference that it would not be distasteful to domestic cattle.

MANAGEMENT, ACCOUNTS, FORMS, ADJUSTMENT OF ADVANCES.

There is no more important subject than that of management, as no success can possibly be obtained without a thoroughly organized system, but this must be governed in a great measure by the size and requirement of the plantation. The manager ought to be a person who has a perfect knowledge, both theoretical and practical, of his business, and should be ably seconded by qualified assistants to supervise each branch. One assistant is required for every five hundred acres, and the factory work ought to be carried on under the personal superintendence of Americans or Chinese, as this is the most important duty required, and one in which competent persons should be employed.

Having now concluded my observations, which are the result of personal experience, I will only express the hope that my efforts may meet with approval, and lead to the serious attention, on this most interesting subject, of the enterprising capitalists of the United States of America.

Prof. Jas. A. Whitney moved that a vote of thanks be tendered to Mr. Shipp for his interesting and instructive paper which was unanimously adopted.

REPORT ON BREEDS OF POULTRY.

Messrs. J. B. Lyman, A. B. Crandell, J. V. C. Smith, John Salisbury, Jr., and John W. Chambers, appointed to visit the exhibition of the New York State Poultry Society, reported that they went to the scene of the show and found all the well-known varieties represented. To obtain a condensed and trustworthy account of the best breeds they addressed questions to several well-known poultrymen, and received answers, of which the following is the gist, and which they regard as entitled to much consideration: 1. What breeds are at present most prized? A. Different breeders disagree, but it is at present thought that the majority prefer the Houdans, dark and light Brahmas, and Leghorns. 2. Are pure breeds preferable? A. The pure breeds are better than half-breeds, as layers, but not quite so hardy. 3. What fowls are best layers? A. White Leghorns and Aylesbury ducks. 4. Which grow fastest and make most dressed-meat? A. Creve Coeurs, light and dark Brahmas, or Aylesbury ducks. 5. For eggs and flesh both, which are best? A. Houdans. 6. For flavor and tenderness of flesh which breeds excel? A. Houdans, Dorking, or Game and Rouen ducks. 7. For mothers which

have you found best? A. Game and Dorking. 8. Is the Dorking hardy in this climate? A. No. 9. What feeding and range do you recommend? A. Ground feed in the morning mixed with warm water, whole grain at night, a little meat occasionally in the winter, with some broken oyster shell, all the range possible, and a good warm house, are all that is necessary. 10. What is your opinion of poultry-raising on a large scale? A. It can be done with great profit if the grounds and houses are large enough. Every hundred fowls should have at least an acre.

Adjourned.

December 21, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

SALT FOR STOCK.

Mr. John Rice, Elliottsburg, Pa., abstains from the use of salt in his own food, and is sure he improves his health thereby, and he thinks it might be so in the case of his horses and cattle.

Prof. J. A. Nash.—There is no chance for controversy, as the experience of all has proved that cattle cannot be kept in the best condition where salt is withheld. It is better to let them have it handy, and use more or less as they require.

Dr. J. V. C. Smith.—In countries where the people do not have salt, parasites are prevalent and destroy life. In 1844, traveling in Kentucky, several paths were pointed out to me which led down to "licks," and some of the most terrible fights are said to have taken place at these "licks" among the many wild animals that visited them from near and far; their instinct taught them how important salt is.

Mr. A. J. Dufur.—Every good practical farmer will see to it that there is a convenient salt lick in each of the fields which his cattle frequent. I might, if it were worth the while, recite the experience of a very intelligent dairyman, who proved repeatedly that his cows could not do without salt.

Prof. J. A. Whitney.—It is true that salt is necessary for all animals. There once came under my notice an instance of a cow that was fed no salt during a whole summer. The milk and the butter had a bad odor and a worse taste, and was small in quantity beside. In the middle ages deprivation of salt was one method of punishing prisoners. They grew weak, and after a while died of inanition.

Mr. F. D. Curtis.—We know that cattle on the plains of this country, and on the pampas of South America, flourish without salt, but deer seek the "licks," which latter fact proves that animals crave salt when wild, and those domesticated love it; but it should be fed in small quantities, if not fed regularly, as it creates thirst. The best practice is to keep it in a tight tub always before the stock.

Mr. J. B. Lyman.—I have observed that it is the practice of certain good dairyman I have had the pleasure of meeting to keep a good-sized chunk of rock salt always in each animal's manger.

WINTER BUTTER.

Mr. Francis Collins, of Morrisville, Penn., forwarded the following valuable communication.—As soon as the milk is brought in, strain it, and set the pan into a pot or boiler of hot water, such as stands on every kitchen stove, taking care that the water is not hot enough to scald the milk, and let it be until the milk *begins to wrinkle.* If the milk is scalded it will not produce cream. This is but very little work, except when you have a large dairy. The cream should be skimmed with as little milk as possible. Save a teacupful of sour cream from the last churning to mix with that newly skimmed. This is done for the purpose of souring the cream as soon as possible, which we consider very important. While we have followed the above directions we have never had bitter butter. We believe that souring it soon prevents the cream or butter becoming bitter, and helps to render the churning easier. In souring the cream the thing can be overdone, and judgment must be used not to let it get too sour. When it gets too sour it looses its smoothness, and has a curd-like look. The cream kettle should be kept all the time in a room where the fire scarcely ever goes out, and at a considerable distance from the stove, where the temperature would be from sixty to sixty-five degrees. It is designed that when the first cream is skimmed into the kettle, that the cream shall be soured and got up to the temperature of about sixty degrees as soon as possible, and kept up to that temperature. Do not keep the cream at a low temperature, and then, when churning day comes, try to suddenly bring it up to a suitable temperature for churning. Neither cream nor milk should ever be kept in a close place. Cream should be stirred several times a day, to prevent the top of it having a cheesy taste. Skim at least once a day. Don't add any cream to the kettle the day it is churned, because it will be likely to lower the temperature too much. Have a

stirrer made out of some hard and tasteless wood, (hickory is excellent,) and keep it all the time in the cream. In winter, when, from lack of green, succulent food, the butter loses some of its color, the addition of carrots improves the color and taste. Grate the carrots the evening before churning day, pour boiling water over the mass, and let it stand till morning, when it is to be strained into the cream. Five days between the churnings is a good time, rather to be preferred to a week. The churns should be scalded out, leaving the hot water in about one minute, but not so long as to warm the churn too much. If the temperature of the cream is just right (sixty or sixty-two degrees in very cold weather) the churn should neither heat nor cool the cream. The milk room must be well ventilated, and never allowed to come down to the freezing point—ours being one adjoining the dining room, where a fire is always kept. The milk never freezes, and probably never gets above fifty degrees. No article that throws off much smell is ever allowed in the room. This is a good rule, and perhaps necessary for No. 1 butter, but in most families cannot be lived up to. We consider clover, or clover and timothy mixed, the best fodder for cows; corn stalks alone, without any grain, the poorest. To make the most and best butter, grain of some kind should be fed. We prefer corn meal or corn meal and bran mixed. Green food is not absolutely necessary for making good butter. Regularity in qauntity and quality of food is necessary for keeping up the flow of milk, but not the quality. Never let the flow of milk decrease greatly, because it is hard to increase it in winter or spring. Feed most all the green food, such as turnips, cabbages, rutabagas, &c., to your milch cows. At this time of the year, I feed all such vegetables during the time of the evening milking. It takes nine or ten hours for the smell of such things to pass away from the cows. Great care should be taken that the cows eat it up clean, and leave none to eat during the night. You can hardly be too particular in feeding strong smelling food. Observe the rule, viz., that none be eaten within ten hours previous to milking. Our last seven churnings, except the fifth, which was guess work, occupied the following time by the watch: First week butter came in seven minutes; second week butter came in six and one-half minutes; third week butter came in six and one-half minutes; fourth week butter came in five minutes; fifth week butter came in five minutes; sixth week butter came in eight and one-half minutes; seventh week butter came in six and one-half minutes. Total time,

forty-five minutes; average, six and one-half minutes, and in from one and one-half to two minutes the butter was fully gathered, and each time was good solid butter. I noticed the temperature of cream only at the sixth and seventh churnings. At the sixth, the temperature of cream, fifty-six degrees (a little too low); of milk house, thirty-eight degrees, and room where cream was kept, from sixty degrees to sixty-four degrees. At the seventh trial the cream was at fifty-nine degrees. The kind of churn used was the old-fashioned barrel churn. Don't need any patent ones.

Report on Carragean, a New Article of Food.

The committee of ladies, Mrs. Conner, Mrs. Bruen, Mrs. Cushing, Mrs. Lyman and Mrs. Chambers, requested to report on the nature and value of Carragean or Irish moss, as a dish for the table, find that the substance grows on rocks and stones on the seacoasts of Europe, and in peculiar abundance on the Atlantic coast of Ireland, where it is chiefly gathered. It is said to be a native of the United States, and is found in limited quantities on the coast of Massachusetts. It is picked from the rocks at low tide. After being washed it is dried in the sun. Chemists and doctors who have analyzed it, find it is nutritive and demulcent, and being easy of digestion, it forms a useful article of diet as a substitute for grain foods, and is particularly recommended in chronic pectoral affections, scrofulous complaints, dysentery, diarrhea. Carragean is very gelatinous and very valuable as food. It is recognized as superior to all orders of moss as demulcent, and in its nutritive qualities. It is said that Napoleon Bonaparte said to Dr. O'Meara, that it was employed by physicians in Corsica, in the treatment of tumors and cancers, on account of the iodine it contains. It is used in England and France as a light and nourishing article of diet.

The moss as it comes from the sea, is filled with sand, pebbles, small shells, &c., and very saline in taste, and prepared as food in its original state, is very troublesome to the housekeeper, while it is very easy to prepare when made from our sea moss farina. By our process it is first thoroughly washed and deprived of its extreme saline taste. It is then picked over by hand, and dessicated, after which it passes through several mills and machines, by which it is cleaned perfectly, and reduced to a powdered and concentrated condition without being deprived of its refreshing ocean flavor. A packet of corn starch, maizena or farina, costs sixteen cents at retail,

and makes, combined with milk, without eggs, only from four to six quarts of blanc mange pudding; while sea moss farina, costing twenty-five cents, will produce full sixteen quarts. The committee are satisfied that as a cheap, simple and ready dessert, or a dish for young children and for invalids, it will be found as thus prepared, a valuable addition to articles more generally known and widely used.

The Falling off in the Wheat Crop.

Mr. James Gilbraith, Landisburg, Pa.—Some years back, or in the earlier settlement of our country, thirty, thirty-five, and as high as forty bushels of wheat have been produced to the acre; but now from twelve to fifteen, and at the farthest twenty or twenty-two, is the outside that can be raised. This is not owing to want of fertility in the soil; where the ground is made good by manuring so as to produce a good crop, the wheat will lodge and not fill; this is the evil in our time. Some suppose that it is because the ground has been too long worked, that it has lost its original properties necessary for the different kinds of grain; but how is it with England, where the land has been worked for centuries, and they can raise from forty to sixty bushels of wheat to the acre? The long-continued culture of the land cannot be the cause. Others suppose that in England it is the root culture, making more of a variety in the crops, not having such a regular succession of green crops as we have. Our best land is limestone; our next best red shale. Our crops are, first, corn; second, oats; third, wheat; next, red clover, which is mowed for hay, and clover seed one or two years; then turn down the clover seed and commence with corn. This is generally our round of crops, or sometimes a crop of clover in full bloom is turned down for wheat. Why is it that our wheat crops are not so good as they were and that the increased fertility of the soil causes more abundant growth of straw and not a corresponding amount of wheat, the straw not having strength to support the wheat until it fills?

Mr. John Crane.—My grandfather used to raise a crop of forty bushels of wheat to the acre; after a while it dwindled to ten; he brought it back to twenty-five by applying guano at the rate of 200 pounds per acre. Our correspondent would doubtless find advantage from similar application. Of course there must be no falling off in the use of other fertilizers.

Mr. W. S. Carpenter.—As I understand it, the straw is weak. It

so, bone-dust will stiffen it. My use of guano in a similar emergency only served to increase the difficulty.

Prof. J. A. Nash.—It is probable that he "runs his land too hard," as we may say in the country. For stiffening the straw there is nothing so good as agricultural salt, at the rate of five bushels per acre.

Dr. E. W. Sylvester.—I should judge from the description that the land in question is clover-sick, aud if so, bone-dust, lime, and leached ashes will restore it.

Mr. P. T. Quinn.—There certainly is a difference between the skill of farmers or in the climate, and I don't know which. The English wheat grower can get thirty and forty bushels as often as the farmer on this side can get twenty or twenty-five bushels of wheat. I think the difference mainly in the kind of manure used. For a time, for a series of years, clover will do all that needs to be done to make a good wheat soil, but there comes a time when clover turned under won't make wheat. The English use more bone than we do and the droppings of stall-fed beasts, especially such as are fatted on oil cake. I would recommend to try bone and strong stable manure. Salt has been found excellent on some soils to stiffen straw, and Mr. G. should try it. But as the subject is one of the first importance, I move that Mr. Galbraith's letter be referred to the Hon. George Geddes, of Syracuse, with the request that he favor the Club with his experience. This motion was carried unanimously.

Protection for Farmers in the Market.

Mr. Frank D. Curtis.—The farmers of the State have revived the idea of uniting together in associations for mutual protection and for the advancement of their interests. In the town of Cambridge, Washington county, they have held several meetings, and are earnest in their endeavors to accomplish something in this direction. In the spirit of progress, and with the laudable desire to aid the farmer, this Club has appointed a committee to report upon the possibility of doing away with so many "middlemen," and so many profits between the producer and consumer, thus helping both. Now, if it is possible to devise any scheme to increase the income of the farmer which is now running very low with the decline in the price of his products, and thereby make his toil more remunerative, it should be done. I am not clear in my mind how such an important result can be accomplished; hence I think it would be well to make this matter a subject of discussion, and to request the committee alluded to to

push their inquiries into the general question of association as well as a better system of marketing. Every other business has its organization. Why should not the agriculturists of the country, the most important of all, be not organized?

Mr. J. B. Lyman.—As chairman of the committee referred to, I would say that we are in possession of many facts that show great abuses of the trust which farmers put in factors or middlemen. For instance here is a letter from Nelson Payne, of Auburn, N. Y., showing that on the 28th September he shipped ten barrels of Dutchess pears of the finest quality. A firm on South street sold them for a little over five dollars a barrel when that very week prices of such pears were ten and twelve dollars a barrel. I have heard of a great many such cases and the committee are studying some method for relief for the farmer. One defense we may make that will have some power; to publish in these reports the name and address of merchants who are shown to be so careless or slow in handling farm produce so as to sacrifice the interests of the shipper. The committee invite letters from farmers whose returns have been so far below market figures as to warrant suspicion.

Mr. J. W. Gregory.—There is no better way out of all these evils and afflictions than for the government to take charge of the transportation of the mails. The great monopolies must be broken.

Mr. J. B. Lyman.—When the committee have obtained all the facts we will be able to suggest several methods of relief. What we want is a capable man who will stand up for the farmer against monoplies, middlemen, and politicians, too, if necessary.

Mr. D. B. Bruen, of Newark, N. J., an old and much esteemed member of the Club, spoke at length on the above text, and was listened to with close attention. The laborer is more especially interested in being properly protected in the expenditure of his daily wages than any other class; but every individual, whether a poor man or a millionaire, has the same right to protection from fraud. There is no article of food so necessary for the support of human life as bread. The price of a loaf is a fixed fact, whether it weighs more or less. Many bakers put up conspicuous notices in their places of business, "Large Bread." Whether their large loaves are puffed up by some chemical process, or by the use of some deleterious article lighter than flour, or by their liberality to the laboring man, to give him more for his money than his fellow-tradesman, is a question that can only be solved by the use of the sealer's weights and meas-

ures. The manner in which poultry is brought to market for sale is another fraud on the public which requires better regulations. Some cities require all poultry brought to market for sale to be cleanly dressed, with the giblets left in, and the head cut off near the body. It often happens that turkeys and fowls of all kinds, are well fed with corn before they are killed for market, with the corn left in the crop, head on, and entrails in the fowl. A turkey weighing from twelve to twenty pounds, with the corn in the crop, and head and entrails, will add one to two pounds to its weight, a considerable item in the cost of a turkey, when selling at thirty-five to forty cents per pound. Let poulterers charge what they please for their fowls, but let them be divested of every part that is not eatable, except the bones which hold the body together, then the purchaser will not be compelled to purchase corn at thirty-five cents per pound at retail, when he is not in want of the article. The unwholsome meats that are offered in the markets for food, is another evil that should be reached. If any member of the Club will go through Washington Market for six days in succession, he can see the flesh of scores of veal calves that never were born. The prices paid for beef by retail is extortionate. The highest price for first quality bullocks, the dressed meat averages for a long time past, sixteen cents per pound. It is an old saying that a bullock makes five quarters, or, in other words, the hide and tallow make the fifth quarter. The average weight of the dressed meat of first quality bullocks is 850 pounds. The cost of the dressed meat at sixteen cents is $136. In cutting up and retailing, one half (425 pounds) will bring twenty-five cents per pound, which is $126.25; medium cuts will bring sixteen cents per pound, which, for 225 pounds, is thirty-six dollars; the rough meat, 200 pounds, twelve and a half cents per pound, is twenty-five dollars; the hide will average eighty-five pounds, nine and a half cents per pound, is eight dollars and eight cents; tallow will average eighty-five pounds, at six and a half cents per pound, is five dollars and thirty-three cents, making $180.80 cash realized for the bullock. The bullock costing $136, leaves a clear profit of forty-five dollars and seventy-six cents on the outlay of $136. The great cause of keeping up starvation prices for produce of all kinds brought from a distance, and preventing competition and a liberal supply at all times, is the tell-tale telegraph wire, which prevents all produce from coming into the market into greater quantities than a supply sufficient to command extortionate prices. Fish, both scale and shell, reach the market only

through middlemen. For three or four years previous to the last, I was at different localities on the sea shore where fisherman follow it as a business. Prices for sea bass in New York averaged through the season twelve to twenty cents per pound, while the highest price the fisherman received was five cents per pound, and the greater part of the time but four cents. At Tom's River clams sold to wagoners for two dollars per thousand, and carted thirty or forty miles in the interior of the country and retailed at forty to fifty cents per hundred, while the same article was retailed in New York markets for one dollar per hundred. Vegetables and fruit seldom reach the consumer but through middlemen. They are monopolized before they reach the market, and generally kept on hand until they become unmarketable, rather than let competition regulate the price. But little is known by the community how almost every article of the productive agricultural industry of the country is monopolized, and reaches the consumer only through middlemen. At Albany I have found the price of beef to average five cents per pound less than in New York. At Utica, Syracuse, Auburn, Geneva, Elmira, and all the principal towns west of Albany, the price of beef would average ten cents per pound less than in New York. Near the terminus of the railroads coming into Albany and Troy, there are extensive cattle yards, where cattle are herded until the tell-tale telegraph wire informs the monopolizers that it will answer to hurry their cattle to market. By this means the price of beef has been and will be kept up at starvation prices, so long as capital can control the market. For a number of years I had my butter sent to me by a friend from western New York, at the difference of ten to twelve cents per pound less than New York prices. My correspondent at length informed me that New York monopolizers went through the country and made their contracts with dairymen for all the butter they made, and required all the tubs to be regularly numbered to prevent any outside dealing, and that the only way he could supply me was by the dairyman making two tubs of the same number, and letting him have one. For two years afterward I got my butter from ten to twelve cents per pound less than New York prices, but my friend was obliged to take a twin number, without any choice of quality. I was obliged to abandon my western supply and pay New York prices, to get the same quality of butter that I had formerly had at producers' prices. When in Illinois I inquired the price of potatoes, and was told that if they were delivered on the wagon they would be three cents per bushel,

but if the purchaser would take them from the cellar, he would be welcome to them. These potatoes could have been delivered in New York for twenty-five cents per bushel, but before monopolizers or middlemen would have allowed them to come into market at the price they could be afforded at, they would have purchased them and thrown them into the river. A friend of mine in Cambridge, Illinois, sold his wheat at Geneseo depot, on the Rock Island Railroad, for seventy-five cents per bushel, and carted it ten miles. I do not recollect the price of flour in New York at that time, but I recollect the impression made on my mind, that I could not comprehend the low price of wheat on a railroad in Illinois, and the high price of flour in New York. It is unnecessary to particularize any further the burdens the community have to bear in consequence of productive labor not reaching the consumer through the legitimate channels of trade. Just so long as capital sufficient for margin in speculating or gambling in the productive resources of the country can be controlled, and the telegraph wires reaching every western country town, by which information can be communicated, and answers returned with lightning speed, just so long will the consumers of the productive industry of the country be compelled to contribute their hard earnings to the support of the most bloodthirsty set of vampires that ever disgraced a community with transactions they call business. There are many other grievances in market regulations than what I have named, or in the neglect of them, that are burdensome to the public, and prevents the producer from realizing his share of the plunder that is extorted from the community by middlemen, which call for reform.

MUCK.

Mr. James Frisbie asks the Club to give their experience in the use of muck as a deodorizer, and its value as a manure.

Prof. J. A. Whitney.—The acids of muck are just suited to fix and correct the alkali of decaying matters. Hence a mixture of muck with bad smelling things about a yard. The worse the odor the more it will be improved by muck, and the more muck will be improved by it. Raw muck has little plant food in it, that is, little of lime, potash or phosphate. As a rule I doubt whether it will pay to get it out and cart it over a mile.

Mr. J. B. Lyman.—The best results I ever saw from raw muck was on a field in Connecticut. The muck lasted six or seven years, and the corn was a half bigger. But it was mostly rotten leaves

especially beech and oak leaves, which have a good deal of lime and potash in them. The best regular dairy farmer in that State, S. M. Welles, of Wethersfield, hauls his muck three miles, and he makes it pay to do so. He has doubled the intrinsic value of ten or twenty acres about his barn, because by using muck behind all his cows, he hauls out three times as much manure as he did before he took to using muck. He keeps his muck dry, and wheels it into the stable every day. He carts several hundred loads every fall, and keeps it in a big bin or cellar. His stable floors are all water-tight.

Salt as a Manure.

Prof. Charles Eggert, Iowa University, Iowa City.—As a partial answer to certain inquiries about the value of salt as a fertilizer, the following facts may prove of interest:

1. Neither of the two elements of common salt, chlorine and sodium, is found in the majority of plants. Sodium exists only in the sugar beet, and in certain plants growing near the seashore, &c., (salsola, salicormia, &c). These plants, including the sugar beet, belong mostly to one family, the *chenopodœ.* Ever since the Frenchman Peligot (vide transactions of the Paris Academy, November, 1867), examined this matter, the fact, as just stated, has not been contradicted. Neither the grain nor straw of wheat, nor the wood of the oak, the leaves of the tobacco plant, nor the roots of parsnips, nor the tubers of the potato, contain any sodium. Although all plants contain largely potassium, and this element is so nearly akin to sodium, investigations have satisfactorily proved that in most plants, the latter can never be substituted for the former. Certain sea plants that contain sodium, can be easily made to substitute potassium for it, but not *vice versa.*

2. Experiments with *pure* salt have demonstrated the fact that the soil is not benefited by it. Cases seemingly in contradiction with this fact are known, but they form no exception, inasmuch as salt is often impure, and its impurities, particularly magnesia, one of the most powerful mineral manures, have been proved to be the real cause of the beneficial effect.

3. There is, however, one possibility left where salt may directly aid vegetation, viz: when the soil contains at the same time a great proportion both of lime and of organic nitrogenous substances. In such a case there will be formed, of the carbonate of lime and the chloride of sodium (salt), chloride of potass and carbonate of soda. The latter,

by oxidizing, affects the organic matter and thereby changes, sometimes in little more than two months, into what is well known as Chili saltpeter, a most valuable mineral manure, by virtue of the nitrous and phosphoric acids it contains. Without the salt this process would likewise take place, but it would require very much more time.

THE CODLING MOTH.

Mr. G. N. Smith, Berlin, Wis., forwarded the subjoined account of personal experience with this insect enemy. In the month of July, 1868, I accidentally discovered that the miller known as the codling moth had a great liking for vinegar, and I accordingly took measures to test the thing by hanging on some of the trees open-mouthed vessels, and putting in them some of the fluid diluted. The first night proved it to be a perfect success, for in some of the dishes I caught in each from ten to twenty of the millers. At that time the millers were so numerous that I expected they would entirely destroy my whole crop of fruit, as it had thus early began to drop from the effects of their work, but so attractive to them was the vinegar that they took to it rather than the apples, and the result was that what fruit I gathered for the winter was entirely unaffected by the worm. I estimate by thousands the number of millers I caught that season. The past summer I commenced operations, say about the middle of June, in the following manner: I obtained as many empty oyster cans as I have trees—the cans in our western towns are plenty and cost nothing—I cut them in two in the middle, flared the sides to the lower part, and put in a wire bail; to the bail I attached a wire to hook on to a twig or limb of the tree. Of the upper part of the can I used enough to make a roof or covering to keep out the rain, made a hole through the centre, and strung it on the wire; then put in the cans cider vinegar, somewhat diluted, sufficient to have it an inch or two deep, and hung them near the centre of the tree. The millers did not make their appearance until about the middle of July, which I attribute to the very cool weather up to that time; and then the vinegar being ready for them, they went for it. The result was I had them, and continued to have them, although they were not as numerous as they were the year previous throughout the season. My fruit is almost entirely free from the worm, as I am not aware of having a score of apples affected the present season.

The Chairman.—It is certainly easy enough to test this prescription.

Mr. A. S. Fuller.—The idea of our correspondent may be a good one. I hope others will try it and report.

GEOLOGY AND FARMING.

Mr. P. T. Quinn, offered the following:

"*Resolved*, That the Farmers' Club of the American Institute, tender an invitation to Prof. George H. Cook, State Geologist of New Jersey, to read a paper on the geological formation of New Jersey, giving such information as he may consider of interest to the farming community."

Prof. J. A. Whitney.—I second the motion very cheerfully. Any one who has read Prof. Cook's voluminous report of the geology of New Jersey, will, I am sure, be glad and anxious to hear him speak, and will go away wiser than he came, on practical points of agriculture.

The Chairman.—I have the pleasure of slight personal acquaintance with Prof. Cook, and have known him by reputation for a long time. His appearance here will add value to our proceedings.

Mr. P. T. Quinn.—I learn that he is making efforts to be with us frequently, but his duties to the State, and to the agricultural college of which he is chief, may prevent.

PLUM GROWING.

Mr. Ira Brown, New Haven, Vt.—My success with seventy of the most popular varieties, has been all I could desire; and that, too, without the use of dunghill fowls or swine. Moreover, I doubt the benefit of those last named filthy creatures. They will eat half ripened plums I know, but I have not seen a hog that would eat them only one-third grown, when the larvæ is in the fruit; but half ripe it has gone. Nor did I ever know of a chicken swallowing a curculio. I allow nothing but a horse and a plow or cultivator attached, to pass among my trees.

Mr. H. B. Smith.—I think the gentleman is wrong on this point, at least. I have frequently fed curculios to fowls, and seen them gobble the creatures in short meter.

CORN COBS.

Mr. John Rice, Elliottsburg, Penn., wished to be informed if corn cobs cut fine and mixed with grain, are worth anything as feed for cattle.

Mr. W. S. Carpenter.—Yes; but they must be boiled. A gentleman of my acquaintance once made experiments, feeding one cow on hay and one on cooked cobs; and the result seemed to show that the latter possesses a good deal of nutriment.

Dr. E. W. Sylvester.—Years ago I kept twenty cows, and supplied the neighboring village with milk. I tested various sorts of food, and thought I proved that cobs, ground fine with corn, are worth, say fifteen per cent. I may also remark that other experiments convinced me that I secured the best milk and most cream, by feeding each animal pure corn meal at the rate of four quarts a day. For milk that sold well, I preferred corn and cobs ground; and for producing the greatest quantity without regard to quality, I preferred buckwheat.

Prof. J. A. Nash.—The value of cobs must, I think, depend on how the animal is kept. Two things are requisite; food not only rich but of sufficient bulk to produce proper distention of the stomach. If you are feeding with something bulky in itself, probably cobs are of little help; but if the food is in condensed form, the case is quite different.

Prof. J. A. Whitney.—I think that in practice there is little profit in feeding corn cobs, because the grinding and boiling will cost more than the feed they furnish is worth. A number of years since, the Albany Cultivator published an experiment with corn cobs boiled whole and fed to cows. It was stated to have been successful in helping out a scant supply of fodder in a hard winter. The nutriment, what little there is, is of a starchy character, and contributes to making fat, but not so much to flesh.

Adjourned.

December 28, 1869.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

POTATO DIGGERS.

Mr. J. P. Davidson, of Rome, N. Y., forwarded photographs of a machine. Dr. Hexamer said it would be impossible to judge of its value, otherwise than by seeing it in operation. The trouble with most implements of the kind is, that they clog with the vines.

Mr. Wm. S. Carpenter remarked, that he had tried almost all the implements of this sort introduced into the market, and he would not give two cents for any of them. He attaches a yoke of oxen to

a two-horse plow and runs it deep. This covers some of the potatoes, but enough labor is saved to make it pay.

Mr. J. B. Lyman.—Judging from the picture, this machine cannot be sold for less than $120 or $130. Few farmers are willing to pay as much as that for a tool that is used a week, and then gathering rust for a year. It must require two and probably three horses to work it, and that is an objection. I saw the other day, at the Trenton Agricultural Works, a digger that can be sold for sixty or seventy dollars, yet digs clean, and can be pulled by two horses. Most inventors fail, by trying to make a machine that attempts too much, and costs too much.

Manures for Corn.

Mr. James H. Ball, North Nassau, N. Y.—In planting corn last spring I was anxious to get some commercial fertilizer to take the place of hog manure in the hill. Not finding any ground bone or ground fish in the Albany market, I tried a barrel of double refined poudrette in competition with hog manure, hen manure and plaster, and ashes and plaster, the plaster being about one-fifth the bulk of the two other mixtures. Commenced planting on west side of piece May 25, using about a gill of ashes and plaster to a hill till the supply was exhausted; then left four rows, planting the corn dry; then used hen manure and ashes, about a gill to a hill, till that was used up; then planted four rows dry; then used poudrette, also about a gill to a hill; then four rows dry; then used hog manure that had been mixed with four times its bulk of muck; of this we put perhaps a quart in each hill. In each case the manure was covered with earth, and the corn planted on the covering. It all came up very nice, but from the start that on the hog manure took the start, and could be distinguished by its ranker growth and darker color, as far as the piece could be seen. June 23d, I looked over the piece, and could see but little difference between that where the ashes were used and that planted dry by the side of it. Where the hen manure was used it was one-third larger than that planted dry by its side; poudrette about twice as large; the hog manure four times as large as that planted dry by its side, and remarkably fine, dark colored and stocky. I cut up 100 hills of each kind, husked separate, and weighed in the ear. The weight of the 100 hills where the ashes and plaster were used, I am unable to give, but it differed but little from the hen manure. The ears from 100 hills hen manure, weighed fifty-three pounds; poudrette weighed forty-six pounds; hog manure weighed

ninety pounds; without manure, weighed thirty-nine pounds. The soil was a gravelly loam, and had, perhaps, eight loads of yard manure to the acre, spread and plowed in, before planting.

Mr. W. S. Carpenter.—I cannot advise poudrette for corn. It makes great growth of stalks to be sure, but it fails when the time of earing comes. It is good to give a start to the young blade, but there must be other manure used broadcast in connection with it.

Dr. E. W. Sylvester.—In the experiment cited, I have no doubt the benefit was increased by the combination of muck and hog manure previous to application. Many farmers suppose it is the fact of applying muck and rank manure that benefits. Not so. It is the composting that benefits both, and makes one ton of the rank manure no better than three of the compost.

Mr. H. L. Reade.—I can indorse all that is said about hog manure for corn, properly composted. I have used it myself with great advantage, making a shovelful suffice for eight or ten hills.

On the Improvement of Wool.

Dr. Lewis Feuchtwanger.—The raising of sheep and the production of wool form one of the most important branches of domestic economy in the United States; for, by looking over the commercial papers last week, it appears that the sales in Boston were 750,000 pounds; those in New York, 250,000 pounds. The monthly sales of wool in California reached 2,000,000 pounds; the aggregate value is about $2,000,000 per month in the United States, at the present low prices in market. There is much room left for reflection on this subject, for it is well known that wool may be much improved, and its value very much enhanced, if all practicable care is taken in the management and regular feeding of the sheep; as the farmer may convince himself of this fact particularly in the long stapled kinds of wool, where the want of good and sufficient food is shown in the irregular growth of wool, by which the staple is rendered tender at that part which was growing when the check to its supply took place. That climate, locality and soil have a most important influence on its value, for all see that some breeds assume peculiar characters; and that a sheep raised on rich and warm plains would not thrive as well if transferred to a bleak and mountainous district, and would then injure the wool. The influence of the soil upon the value of wool has been long ago demonstrated in the west of England, where, in some parts, the blue sand communicates to the

wool a brown color and a harsh character, while in the chalk districts the wool is of a white color and rather dry, harsh fibers; but the Wealdon clay counties produce a wool which is softer, cleaner and the most valuable in that country. Digestion forms the most important vehicle whereby the sheep is sustained in proper condition, and the wool thereby improved. The organs by which this function is performed in the higher animals are the mouth, pharnyx, æsophagus, stomach and intestines, with their accessory salivary glands, pancreas, liver and mucous follicles. The first act to which food is subjected is the mechanical division by the teeth. So important is this, in order that it may be influenced by the salivary secretions, that it may be said as an axiom that food well chewed is half digested; but the golden rule, however, is constantly neglected, for which we have to pay the penalty of dyspepsia. All good wool growers are particular about the food of sheep. They should be fed in such a way that they will eat slowly and masticate perfectly. Wool abounds in potash, and all food well adapted to sheep feeding should be rich in this important substance.

DWARF APPLE TREES.

C. L. Lawrence, of Plain Grove, New York, has an orchard, planted four years ago. He has pruned them each summer; the ground is in grass, and not cultivated, and he has never yet had any yield of fruit. What shall he do about it? Also, what is the comparative value of corn and potatoes as food for stock?

Dr. E. W. Sylvester.—I should think he might help his orchard by thinning the trees and putting a plow in now and then. If the sod is allowed to hug the trunks he cannot expect much harvest.

Dr. J. V. C. Smith.—I have seen orchards of dwarf trees in the west growing close together, and still the yield was large.

Mr. W. S. Carpenter.—I have had a good deal of experience with dwarf apple trees, and think, as a general thing, that they are budded too low. Also that cultivating the ground increases the difficulty. They will not bear until they reach certain conditions, which may not be until after a series of years.

Mr. N. C. Meeker.—I think a word should be dropped here to caution people from looking for large returns from the dwarf apple trees. They have generally been very little better than the fig tree in the New Testament.

Prof. J. A. Whitney.—In answer to the question about the com-

parative value of corn and potatoes, I will say that dry corn contains from eighty to eighty-five per cent of nutritive matter, a considerable part of which is nitrogenized, and helps to make red flesh, while the starch and sugar tends to make fat. Average potatoes have only some twenty-seven per cent of nutrition, and, with the exception of less than one-half per cent of albumen, this is mostly starch. In round figures, one bushel of corn would be worth about as much as four bushels of potatoes. But, in addition to the actual nutrition they contain, the juices of the potato are wholesome, as they help to digest dry food.

LODGING OF WHEAT ON RICH LANDS.

Hon. George Geddes, Fairmount, Onondaga county, N. Y.—The Farmers' Club of the American Institute has referred to me, for an answer to a letter dated Landisburg, Perry Co., Penn., signed James Gilbraith, M. D., from which I extract as follows: "Some years back, or in the earlier settlement of our country, thirty, thirty-five, and as high as forty bushels of wheat have been produced to the acre of ground; but now from twelve to fifteen, and at furtherest twenty or twenty-two, is the most that can can be raised. This is not owing to want of fertility in the soil. Where the ground is made good by manuring, so as to produce a good crop, the wheat will lodge and not fill. Anything that can be suggested by the Club on this subject will be gratefully received."

Assuming that the doctor has in all particulars stated his case correctly, it certainly is one of great interest. A limestone soil that once produced large yields of wheat, under what must be admitted to be a good rotation of crops, can no longer be made to produce a fair average of the grain, though it will produce largely of straw. Red clover is plowed under, and, in fact, so far as appears from the letter, everything has been done to increase the fertility of the soil by the farmers, that has been supposed to be necessary in other places. Our own farm has been managed very much in the way indicated in this account of the Landisburg processes, and seventy years of cropping has resulted quite differently so far as the yield of grain is concerned. An agricultural chemist would doubtless say that the Landisburg soils had been exhausted of some mineral constituent of wheat, that an analysis would show was now wanting; and he, perhaps, would suggest that there was a lack of soluble silex. The falling of the straw before the heads are filled indicates this. Not being

familiar with the geology or mineralogy of that part of the State of Pennsylvania, and having no report or other authority to refer to, I can only say that I strongly suspect that this is a case where a good chemist would be useful. If I owned land there I should, first of all, have some specimens of soil from the oldest fields, and from land that had never raised wheat, analyzed and thoroughly examined by some competent chemist. We are not informed as to whether the corn crops are good, nor the oat crops, nor the grass. If these crops are as good or better than they were years ago, and the falling off in production is confined to wheat, the man of science should be able to tell us what is the matter; but I suspect that even he would want to visit the locality when crops were growing, and get all the facts bearing on the case, before he commenced the construction of theories. I think the Club should have sent this case to their chemist, rather than to a practical men; but, as it has come to me, I will indicate the policy that appears to me as promising the best result that can be reached without the aid of science.

I wish the doctor had told us what variety of wheat is raised at Landisburg. Mediterranean wheat is very weak in the straw, and on rich land lodges very badly. It is the wheat for poor land. Stiff strawed wheat, on the contrary, is not adapted to poor land, but is to rich land. Acting on this fact, I would try some stiff-strawed variety, such as Treadwell, or, if I had no fears of the midge, the Deihl, which is a white wheat, later in maturing, but worth in the market twelve to fifteen per cent more than the red varieties. Use but little seed, that the straw may grow large and strong. Thick wheat necessarily has fine, limber straw. Use two or three bushels of salt, sown broadcast on an acre soon after the snow is off in the spring. To test the merits of thin sowing and salting, try some ground with the usual amount of seed, and salt in strips, leaving strips of both thick and thin seeding unsalted. Mark the results, and perhaps a lesson may be learned in one year's trial that will be worth something.

In advising the use of varieties of grain that have stiff straw and thin seeding, I am but stating the practices adopted here, as our lands grow more fertile, by our best farmers, who not only try to discern the signs of the times, but to know what their neighbors are doing, and thus draw their information from all that passes around them. To such men the whole country is one great experimental farm, carried on for their information.

MULCHING.

Mr. Peter Dolan, Dolington, Penn., took exception to Mr. P. T. Quinn's recommendation to use hay as mulch for strawberries. According to his experience it fills the soil with weeds, and thereby increases the labor of cultivation.

Dr. F. M. Hexamer.—The hay Mr. Quinn spoke of was salt hay gathered from the marshes near his farm in Newark, and which contains no seed. That used by our correspondent was probably timothy, which is, as he states, a very poor material for the purpose. Where salt hay cannot be procured oat straw may be used; or, what is even better, rye straw. Corn stalks do not answer, but some mulch is, in my estimation, quite important. In fact, if I could not mulch them I would cease the culture of strawberries at once. With me it makes a difference of a hundred bushels to the acre.

MEN WHO MAKE FARMING PAY.

Mr. J. B. Lyman read the following paper:—About twenty years ago, John Daws, a Quaker farmer, whose ancestors migrated with William Penn, came across the Delaware from Bucks county, Pa., and looked at Jersey lands. He bought an old farm of 150 acres in Monmouth county, about twelve miles west of the battle-field. A portion of the British forces camped on the land the night before that memorable action. Mr. Daws gave twenty dollars an acre. The land had been run in an exhausting round of corn, rye, old pasture, till it would not yield over five bushels of shelled corn to the acre, often not more than three. He began with lime, and lime has been his favorite dressing for twenty years. He has applied in all 17,000 bushels, or at the rate of nearly 1,000 bushels a year. His crops have been wheat, potatoes, grass, sorghum and apples. He plants trees that will bear, whether the variety be the best or not; then he makes cider, and converts his cider into vinegar. He has this winter $800 worth of old vinegar in store. Some years he has made $300 income from poultry. He holds his farm now at $150 per acre, and his land is not in the market.

In 1862 he sold a farm to his brother, for which he had given thirty-four dollars per acre a few years ago. His brother gave him sixty dollars per acre, very little in cash, but mostly in $1,000 notes, secured by mortgage on the land sold, the notes drawing seven per cent interest. In six years the last of these notes was taken up. This was done on common farm crops, as wheat and potatoes. The land, meanwhile, has doubled in market value.

A few years ago a German farmer gave his notes for $10,000 as the purchase money of a flat, marshy farm of ninety acres near Trenton. He drained the wet parts, got them into tame grasses, kept as many cows as the place would carry, often twenty-five or thirty head, erected all the buildings necessary for the dairy business, and in three years from the purchase lifted the last mortgage note. Two hundred dollars an acre would not buy the property.

These three cases are recited, not as marks of uncommon thrift, but as proofs that with the brave, the industrious and the hardy, he who rises with the sun, and eats no bread of idleness, a rich and profitable farm is not an impossibility, not even a difficult achievement. I notice, too, that the necessity for working off the vendor's mortgage is a wholesome stimulus. Running in debt for the farm on which one lives, is an exception to common maxims about debt. In times like these, when values decline, and merchants tremble, it behooves every man who knows how to grow beans or to feed cows, to set forty acres of firm earth beneath his feet.

Dr. E. W. Sylvester.—I can give an instance of similar import. A poor young man, at Lyons, N. Y., began by working a farm on shares. After awhile he bought a small patch, and gradually added to it. To-day he is worth at least $30,000, and he made it by industry, and not by speculation. His crops are onions, tobacco and mint.

Mr. W. S. Carpenter.—All these persons worked hard, and were economical. The latter fact is to be considered as the great secret of their success.

Mr. D. B. Bruen.—I might tell the story of a man now living in Newark, who began by working for five dollars a month. He thought that was not enough, and soon got eight dollars. Then he went to himself, as the negroes say, and in a few years bought eight acres of land, for which he has refused $16,000. He bought it with lettuce, cabbages and celery.

Mr. J. W. Gregory.—Last spring a planter in Texas took me to his front door, and bid me count fifteen cabins, not large, but surrounded with many marks of thrift. They are, he said, the homes of Germans, who came here a few years ago with no more property than they could carry in a kit. These families are now worth on an average $15,000 each.

Mr. A. S. Fuller.—I was not aware that anybody held farming to be an exception to the rule that steady work and moderate living would make one rich. "Earn more than you spend," is a short rule

and simple, but very hard for young men to follow, whether they hoe potatoes or measure calico. I don't think the place makes any difference. While scores start with Mr. Meeker, for the Rocky mountains, there will be others who will not go beyond the sound of these fire bells, yet they will make as much from a patch that you can throw a stone across, as a Pike's Peak colonist on his square mile. There is everything in the man, and nothing in the chance, for the right kind of a man makes his own chance.

National Defiance Bee-hive.

Mr. V. Leonard, Springfield, Pa., exhibited his National Defiance Bee-hive, also a queen trap, to prevent hives swarming. This hive has some improvements which were thought worthy of trial.

Crushed Bone and Swamp-muck.

Mr. J. Reaser, Orville, Ohio, inquired the cost of a mill for crushing bones on a small scale, and whether a very nice quality of swamp-muck might not be mixed with night-soil, and result in a good fertilizer?

Prof. J. A. Whitney.—Bone mills are made with several pairs of cast-iron rollers arranged one pair above another. The bones pass between the upper ones and are coarsely broken, then in succession through the others, which reduce them more and more, until they are fine enough. These mills are expensive, and no farmer can afford to grind bones in small quantities. Composted with moist unleached ashes, the bones will be gradually decomposed and made fit for use. Night-soil has been very profitably composted with pond-muck, and swampy muck would do quite as well. The muck should be dry, previously exposed for some months to the action of frost and air. The night-soil may be intimately mixed with the muck, and the whole kept under shelter.

Dr. F. M. Hexamer.—The best and cheapest way to make bone dust is to mix the bones with fresh horse manure, and keep it wet. This process requires a year's time, but it is by far the most profitable. No farmer who keeps a horse need be puzzled to know how to reduce his bones. The compost thus made is quite strong, and should be freely diluted with muck or loam. In fact, muck or decayed vegetable matter of some sort, should be mixed with all strong manures.

Potato Culture—The Lesson of 1869.

Mr. P. T. Quinn.—The potato crop of this country is an important one, both to the producer and consumer. It forms a large part of the daily food of all classes; and is frequently spoken of as "the poor man's bread." The failure of this tuber for a succession of years has brought terror to the hearts of an entire community. Twelve or fifteen years ago, when the culture of the Carter potato, and many other old varieties, became unprofitable, and the favorite Mercer was seriously threatened by the potato disease, farmers were alarmed, lest the culture of this edible tuber, as a source of profit, would have to be abandoned. About this time the late Prof. Goodrich was devoting his whole time to the production of new varieties of potatoes from parents of robust habits. A few years later a large number of these "seedlings" were introduced. Among those more generally known and cultivated, were the Early Goodrich, as an early sort, and the Harrison, as a late one. Both of these varieties were exceedingly productive; with ordinary culture yielding 250 to 300 bushels per acre, and not subject to rot. During the years 1865, '66 and '67 the Early Goodrich gained favor, and was pronounced by all to be far the best early market potato. Ripening two weeks before the "Early June" or "Dykeman," producing one-third more to the acre, and commanding the same price in market as these varieties, soon made the Goodrich popular among potato growers. The Harrison, although more productive than the Goodrich, was inferior in quality; but growers said they could well afford to sell the Harrison for twenty-five cents a bushels less than the White Peachblow, and make more money than cultivating that variety. In the spring of 1868 the Goodrich and Harrison were extensively planted for northern markets. The season proved to be very wet, rain falling every two or three days during the summer months, keeping clay ground constantly wet and soggy, making it impossible to give crops the proper culture, or keep weeds down. Owing in part to the season, the yield per acre was far below an average, and the quality of the potatoes so poor that during the fall or winter there was little or no demand for either sort. Speculators who contracted for the Harrison early in the season at three dollars per barrel for seed, were glad to find customers during the winter at one dollar per barrel. One dealer offered to sell me 1,000 barrels of Harrisons for $1,000, including the barrels, which were worth twenty cents apiece.

Thousands of bushels of Goodrich were fed to hogs and cattle, because they would command no price in market.

In the spring of 1868 the "Early Rose," a new variety from Vermont, were offered for sale in small quantities at high prices. Few persons planted more than a peck of this variety, and from that down to a single pound. At harvest time there was only one opinion expressed about this new claimant to public favor, that it was very early, more productive than the Harrison, and a superior table potato, equal in quality to the White Peachblow. Last spring potato growers were at a loss to know what to plant. The previous years' experience with Harrisons and Goodrich were anything but satisfactory. The Peachblow is subject to rot in heavy soils if the season is wet, and the Early Rose, at forty dollars per barrel, was too expensive to plant as a general crop, considering it had only one year's trial. I, in common with many others, were puzzled to decide what to plant under the circumstances. After consultation with some of my neighbors, who are engaged in growing potatoes for market, I decided to make the following division of seven acres marked out for potatoes: One acre Early Rose; two acres White Peachblow; three acres Early Goodrich; one acre Harrison.

The ground was well prepared, and fortunately all the varieties were planted early. The season in New Jersey proved favorable for early planting. The crop per acre and quality of the Goodrich and Harrison were better than I anticipated. However, at first I found it difficult to find buyers. Owing to the inferior quality of these two kinds last year, "middle-men" were very shy about "handling" them. I succeeded in selling the majority of my crop at seventy-five cents per bushel as soon as taken from the ground.

The Early Rose, after another year's trial under field culture, more than fulfilled the expectations of its warmest friends. The same parties who brought the bulk of my crop of Harrisons and Goodrich at seventy-five cents per bushel would give me $1.37 per bushel for Early Rose for table use. Early in the season I sold some Early Rose, and the grocer who bought them told me that he was very sorry his customers tasted the Early Rose this season, for no other kind of potato suited them afterward. It is without doubt the most promising new variety on the list, and will be extensively planted next year for market. In 1868 it showed some indications of rot, but this year the crop has kept well so far.

The lesson learned by the past season's experience in potato cul-

ture is, there will be very few Harrisons planted for market, and the Early Rose will supplant the Early Goodrich.

Storing Potatoes.

Potatoes for table use should be stored in a cool, dry, dark cellar. They will keep better if a small quantity of soil is mixed in with them at the time of storing. When potatoes are left exposed to the sunlight they soon turn green, a bitter principle is developed, and when cooked the tubers have a nauseating and unpleasant taste. Every observing farmer knows that it often happens that a portion of the potatoes in a "hill" are left exposed to the light by the earth wash-away, or by careless hoeing. The exposed potatoes soon change color, and are worthless for table use. This kind of exposure also hastens decay, no matter where the potatoes are kept. Even when purchased for family use in small quantities, say a bushel or barrel at a time, they should be kept in a dark corner of the cellar until consumed.

Delaware Peaches in New York Market.

Mr. C. W. Idell, a well known fruit dealer in Washington Market, called the attention of the Club to the abuses and dishonest practices of the great railroads by which the peach crop of Delaware is brought to market. The number of car loads this year has been 3,800 containing two million baskets. This vast product is hurried forward to the city by special peach trains, and rolled into Jersey City at a little past midnight. The accommodations at the station are anything but what they should be, and the disposition of the employees of the road anything but obliging. The yard is dark; the peach dealers are obliged to employ a special police to arrest the pilferings of catch-carmen, and even the ferries, though they receive $15,000 from this crop, are exorbitant and unjust to the trade. Prices were very moderate during the entire season, in fact so much so as to make the trade monotonous, and the net sales realized by the farmers was about fifty cents per basket. In 1867, the largest number of cars that arrived in one day was fifty-five, and those completely glutted the market, causing a general stagnation for some days. This season we had 175 cars in one day, and they all sold at good rates. In addition to the quantity received, as above stated, there were two large and one small steamers engaged in this business, making a daily line from Delaware. The quantity they carried has

not been ascertained, but the largest steamer brought on one trip 10,000 baskets. It will not do to close this subject until I speak of a peculiar branch of business connected with the running of the peach expresses. A band of organized thieves follow these trains, and at every depot where they stop they make attacks, and the cast iron frames laid over the ventilating holes are not the least obstruction to them; they are broken at a blow, and I am well satisfied that frequently the brakemen and conductors are the principals in the business, for no man could destroy these gratings and not be heard by these officials, and the quantity taken shows that they have plenty of time to carry on their operations, for I have known a dozen baskets of fruit to be taken out through a hole ten inches square, and this must have been done while the train was in motion. The cars of the Camden and Amboy road offer every inducement to these theives, for the ventilators in their cars are on the top. A cast iron grating covers the opening in the roof, which is surmounted with a covering similar to a chimney covering that protects the interior from the storms. This cover they knock entirely off, break the grating and help themselves. Then, as soon as one basket is emptied, they pull up another and take all they want. It is sometimes the case that the door of a car is broken open, and a larger quantity stolen. One morning a car was found open as the train ran in the depot, the conductor being on the top of it, and his reply was to my remonstrance, that he did not care if the whole load was stolen; it was none of his business so that he brought the car in. This feature of the business is encouraged by the mode of freighting, for the road say that if they deliver the car, they are not responsible for the safety of the fruit; be this as it may, they refuse to pay for the stolen fruit. In order that a dealer may be in time for the train he is compelled to rise about one A. M., and he is a fortunate man if he can retire before eight P. M. The commission for selling peaches is ten per cent; this includes the paying for all baskets *he* loses, not those the road lose, loading the cars, and also guaranteeing the sales, making his returns weekly. The carting is four cents per basket; this includes the ferriage, collecting, and returning of the baskets to the cars. The wholesale operations in peaches are made at night by lamp-light, and great mistakes are often made. The system by which the great crop of Delaware is brought to the metropolis needs important changes, and some that cannot be secured without better laws and better execution of the laws than we have.

Mr. P. T. Quinn.—I have had experience, and could give a long catalogue of grievances. Frequently I have had a discount of fifty cents per basket to make in pears on account of the stealings of the railroad men. I never make a fuss about it, because I am perfectly well aware of the difficulty of getting anything paid back. Wealthy corporations who have a monopoly of our lines of transit don't spend their money in that way. Fifty thousand dollars paid to lawyers and senators is much more effective than a defense in court.

Mr. H. T. Williams.—The only remedy is by establishing opposition lines of conveyance. Some peach growers in Delaware found it to their interest during the past season to drive their teams ten or fifteen miles, and connect with the opposition boat, rather than patronize the railroad lines. Some years ago the roads in Delaware took peaches with the usual obligation. Every year one company had from $40,000 to $60,000 damages to pay. The clause spoken of by Mr. Idell was then inserted, and they have had no suits. But the rascalities mentioned by him have sprung up in consequence. I hope the paper will be noted by the committee on markets, and that some suggestions will be made by them looking to a correction of abuses so great and deep-rooted.

Dr. F. M. Hexamer.—I have shipped much fruit from my farm at Newcastle, and never lost anything to speak of. The secret of this is I kept on good terms with the railroad people, from general agent to brakeman. A few baskets of strawberries or other fruit, judiciously distributed has excellent effect.

The Old Year Ended.

This being the last meeting of 1869, the Chairman, as is his custom, made some eloquent and timely remarks. He spoke of the interest which continues to be felt in the Club throughout the country, and of the valuable aid of friends not seen, but who take the pains to put on paper the facts gathered from experiment or observation, and thus advance the good work. During the year the meetings have been unusually well attended, and interesting. Acknowledgments was made to the press for faithfulness in reports, and for diligence in spreading every worthy idea here represented. Said the Alderman, in conclusion: "Let us see to it that among other good words and works, we use our best endeavors to rescue the birds from wanton and cruel destruction. That their services are needed in saving the crops is no longer questioned. How can a boy, large or small,

after listening to the evening hymn of the robin, or the morning songs from the highest limb of the highest tree, as far from earth and as near to Heaven as he can find a place to stand, and sing, joined in full chorus by thousands of warbling songsters, bring out a gun, or throw a stone to kill or maim these happy, useful creatures, who work all the day in helping to rid your fruit trees and grounds of destructive pests. The photograph of every man who is so stingy as to wish to kill a bird for eating some of his fruit should be placed in a gallery, and entitled to the same notoriety as is the Rogues' Gallery at Police Headquarters. Is he not eating the fruit of his Heavenly Father, and does he not know it is written, He feeds the birds, and that not a sparrow falleth to the ground without His notice. Let the voice of this Club go forth as with the voice of a trumpet: *Spare the birds.* There is one other subject to which I call attention. Will you not try to exert the influence of this Club, and to implore the public to join in the effort, to have all dumb animals treated with kindness, and that the brutality which is so general, in our city especially, and which shocks our senses and outrages our humanity, shall no longer be inflicted upon our brute servitors that are used, but oftener abused to gratify the wishes and wants of their masters? "The merciful man is merciful to his beast." "With whatsoever measure ye mete, it shall be measured to you again." Hence I think in that place of torment hereafter there will be cart rungs and heavy butts of whips to mete out the measure to those brutes who have abused the dumb animals. At the conclusion of this address, Mr. P. T. Quinn made some remarks complimentary to the chairman. He said he had never attended any meetings where the courtesy and kindness happily combined with strict parliamentary discipline had been so note worthy and commendable, as uniformly characterized the ruling of the gentleman who holds the gavel at the Farmers' Club, and he was sure he expressed the sentiments of all when he gave words to the hope that it might be long before that emblem of authority would pass to stranger hands.

Adjourned.

January 4, 1869.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Duty on Imported Stock.

Mr. David Logan, Jr., of Hartstown, Penn., suggested the propriety of memorializing Congress for the repeal of the duty on animals imported for breeding purposes. "My own experience," he urges, "has been that the importer finds obstacles and discouragements enough in his enterprise, without meeting him at the gate-way of his home with a twenty per cent ad valorem duty."

The Chairman.—This subject has received more or less attention from time to time in some of the newspapers, and it might be worth while for one of our stock men to consider it anew and report. Perhaps our esteemed colleague, Mr. F. D. Curtis, will take the service upon himself.

The Rhae Plant.

Mr. H. A. Ship, who recently read a paper on the subject of tea culture, forwarded a communication on the rhae plant. It originated in India, is of quick growth, and, in a genial soil and climate, such as may be found in thirty-three degrees each side of the equator, its yield is prolific. It is a kind of withe, and grows to the hight of six to seven feet, or from four to five feet in a somewhat colder latitude than that named, and, in both cases, of a diameter one-half to three-quarters of an inch, and six inches above the ground. It bears several branches out of the same root, all shooting upward like the main stem or first shoot, which may, in some cases, merit that name, not only by the central position of the group, but by a slightly extra thickness. There are no secondary branches on these; so the rhea plant may be said to consist of several twigs or withes, a kind of broom growing out of one root; therefore, it is curious that it should be called a grass, as it is not identical with the China grass, as frequently asserted. Its leaves are few and lanceolate in shape terminating in a sharp, hard point. The flower is a delicate blue, and in form somewhat like the cotton flower, but smaller and more numerous. They grow toward the end of the twigs, and number five or six on each. The bark, in the linings of which lies the fiber, is, when ripe and fit to cut or pull, of a dark olive color, and when dry and rotted and fit for the brake, of deep Vandyke brown. It is a test as to its fitness for manufacture, its being hard, dry and brittle. The mode of

extracting the fiber from the tannin, or colored astringent portion of the bark, is tedious and infinitely more troublesome than any other fiber, except, perhaps, pine apple fiber, and were it not for the excessive value of the beautiful silk-like fiber it would never be undertaken by the natives of eastern countries with their primitive and incomplete method; which consist of beating the bark on a piece of soft wood with a mallet covered with leather. The best soil for this plant is a low bottom, where, however, there is no fear of flood, but where the retentive powers of the subsoil are such as to guarantee a constant moisture; a black loam, with a clay subsoil, is that best calculated to produce a good, long, strong and fine fiber crop. After the land has been well plowed and harrowed, which should be done in April, the seed is sown sparingly in rows, six inches apart, in small drills one inch deep; weed for five weeks, after which the plant will choke down and kill anything that tries to get ahead of it. There can be no doubt that a high state of cultivation would bring forth a better crop. In the month of October the cutting is generally done. As soon as the seed has been rippled off, the plant is placed in a tank or pit of water—soft rain water is the best—from which it is taken out, tied in small bundles, and stood on end in the field for a week or ten days, after which it is spread out in the rays of the sun; fiber not so good in color, some artificially dry until thoroughly dry, hard and brittle. This takes some time. It is then ready for the brake. There can be no doubt as to the utility of this fiber, and also the possibility of its cultivation in this vast continent of so many climes, and such enterprising people. The only question is, will it pay? The writer thought it would, and gave reasons for this opinion. Specimens of the fiber, forwarded by John A. Barset, to Salem, Mass., were shown, and it is understood that the seed is now being experimented with in the gardens of the Agricultural Department at Washington.

Mr. J. A. Gregory.—I have carefully examined this specimen, and compared it with the ramie. They are very similar, except that the rhae grass has the highest luster, and is worth more to mix with silk. This whole subject has a local, but a growing importance and interest. I am right, so far as we now know, in saying that a line from Natchez to Charleston divides the true ramie country from that in which the season is too short for the most profitable culture. It should yield three cuttings, each of about 400 pounds per acre, or 1,200 pounds a season, of clear fiber, worth now sixty cents a pound. I could sell twenty

tons in England at that figure. Seven hundred and twenty dollars an acre is beyond all that the cotton or sugar planter can boast in the most high and palmy days of southern opulence. The difficulty about ramie and rhae grass is this: We have no machine in general use that meets our requirements for separating the fiber. Erastus Bigelow, of Boston, has an invention, newly perfected, which will be likely to meet the case, for Mr. Bigelow is about the oldest and most practical of inventors. When he does for ramie what Whitney did for cotton, rich Forida lands will not be hawked in this Club, as I have known within a year, at fifty cents an acre.

Grasses for Tennessee.

Mr. H. C. Whitaker, New Market, Tenn.—Has wood land, mostly pine and red oak, with some walnut and black gum. It is quite undulating, and isolated from other timbered land; has a yellow clay subsoil of a calcareous nature, and is completely underlaid with limestone. In conclusion, he would get it into grass, and asked the club what variety would be most likely to succeed.

Mr J. B. Lyman.—He should not sow timothy, for the hot sun of Tennessee will be quite sure to kill it. If he has the limestone foundation he mentions, there is no reason why Kentucky blue grass should not thrive. Let him buy a mixture of blue grass, red top, orchard grass and white clover. He cannot know beforehand which may eventually take possession of the surface, probably the blue grass.

Mr. Frank D. Curtis.—The reason that timothy does not succeed in southern soil is because the root is short and round, and dried up. Long, fibrous roots endure the heat much better, consequently orchard grass or red top would answer the requirement. The former is especially adapted to shady places, and red top is also tolerably reliable in this respect.

Cows, Cream, and Churning.

Mr. Passmore Howard, of Delaware county, Pa., asked these questions: Will milk of different cows, if churned separately, vary in length of time required to change to butter? If so, what would be the result, as regards quantity of butter, by churning all together?

Mr. J. B. Lyman.—I had a talk some time since with S. J. Sharpless, of Philadelphia, who makes the splendid butter for which the Continental Hotel is famed. He has made many experiments, and

finds that no two cows are alike in the time in which their cream turns to butter. He has churned the cream of two good cows in the same mess. One would turn to butter first. He took that out and continued to churn, and a second batch of butter was the result. He is satisfied that butter is often thrown away in buttermilk when the milk of different cows is churned together, and says the best way is to churn each cow's milk by itself till the characteristics of her milk are well understood. When he would make a prize article and get the best returns from his dairy he uses the old fashioned up and down churn, and takes the cream from one cow only at a time.

Mr. F. D. Curtis.—But there are cows whose milk it seems almost impossible to turn into butter when churned alone, but which, when churned in connection with that from other cows, changes with comparatively little trouble.

Mr. A. S. Fuller.—And it might be added that the milk of some cows seems entirely unsuited to produce butter. For instance, I once owned a cow which yielded twenty-four quarts of milk per day, and to look at it you would say it must be rich, but we could never get more than four pounds of butter per week. Afterward I changed, and got a cow that, on the same feed, gave only half the quantity of milk and made twice the quantity of butter.

Mr. F. D. Curtis.—There is little doubt that the milk of certain cows is, to a great extent, destitute also of nutritive qualities. A neighbor of mine, in Saratoga county, had a cow which couldn't even fatten her own calf, and the poor thing pined, and I am not certain but that it died. I know there are doubters who will maliciously maintain that the calf had worms or some such thing, but that does not prove the falsity of this statement, and, in the absence of the doctors, I may be permitted to suggest that mothers who bring up their babes on the bottle would do well to make sure that the cow upon which they rely gives good rich milk. I am always particular about this in my family.

KENTUCKY BLUE GRASS.

Mr. P. S. Kennedy, of Crawfordsville, Ind., wrote to say that it is all a mistake to suppose that the above named variety will grow nowhere but in central Kentucky. I was raised in one of the most noted blue grass counties of that State, but for the last seventeen years have lived in central Indiana; and I am prepared to prove to any one who will come here that a great portion of the land in this region is quite as well adapted to blue grass as the best blue

grass lands of Kentucky. I had genuine Kentucky blue grass on my place here this year quite as luxuriant as any I ever saw in my native State. Central Indiana will some day be as famous for blue grass and fine cattle as central Kentucky.

Mr. Elias Vaughan, of Wyalusing, Pa., is quite sure that the soil of his section, a clay loam, underlaid with a strata of lime rock, is naturally adapted to grazing purposes, and he thinks the blue grass would succeed especially well. "Pray, gentlemen, where can I get the seed?"

Mr. A. S. Fuller.—In any of the city seed stores; but he would find it safer to go to some honest farmer. I urge this caution, because it is well known that a large percentage of the blue grass seed sold in New York is worthless. A friend of mine paid nine dollars per bushel for some, a year or so ago, and none of it ever sprouted.

Mr. J. B. Lyman.—There are quantities for sale in Lexington. The Regent of the University of Kentucky, John R. Bowman, would pay regard to a letter of inquiry on the subject; he is not a dealer, but is a good practical farmer, and would not send an inquirer to a man who sells bad seed. As to Mr. Kennedy's statement I will add a word. The limestone of central Kentucky contains phosphate as well as carbonate and sulphate of lime. This is the reason why she beats Indiana and the rest of mankind with her blue grass.

Plowing Under Clover.

Mr. E. Powers of Home, Iowa, desired to be informed "whether it is best to plow under the first crop of clover for manure, or let it remain on the ground until the second crop is ready?"

Mr. A. S. Fuller.—The first crop, I should say, and just before the seed is ripe.

Mr. John Crane.—The second crop, I should say, as there are more roots; and especially the second crop if he wants to seed the ground, as there is not much seed in the first crop.

Dr. E. W. Sylvester.—Undoubtedly the best plan is to plow in the first crop when just past blossoming. It then has a chance to become well decayed before the ground freezes.

Mr. J. W. Gregory.—My practice was to cut the first crop off and cure it for hay, and plow in the second and sow fall wheat on it, during the winter giving a good top dressing of barn-yard manure; and if the early growth was very rank in the spring, to turn on sheep, or harrow and roll it. This we called wheat on clover ley, and it

was usually attended with the best results. The root of the clover does as much good as the stalk, and the older the plant the longer the root. Let him get all he can out of the clover, a good bite of pasturage, a crop of hay, and a crop of seed.

BONE DUST.

Mr. N. Jewett of East Haddam, Conn., patronized one of them last spring, making a purchase of three tons of what was represented as pure bone. He used it on various crops in a way to test its value, but grieves to state that it proved perfectly worthless. The loss to farmers in buying a poor article as fertilizer is not only in the amount paid for it, but in the partial loss of the crop—the latter generally the greatest.

Mr. A. S. Fuller.—Our afflicted correspondent probably purchased vegetable ivory, of which there is always an abundance on sale in the New York market.

Mr. J. W. Gregory.—There are several islands on the southern coast abounding in shells. I am told that ship loads are brought thither "converted," and palmed off by the manufacturers upon unoffending farmers as bone dust.

Mr. A. S. Fuller.—I think we could afford to advertise an establishment where really unadulterable bone dust could be procured, provided we could find such an establishment anywhere, which I very much doubt.

Mr. J. B. Lyman.—Our friend, Mr. Thompson of Staten Island, has a test which will enable farmers to decide readily and positively about the relative purity of bone dust, and he will come here soon and explain it. He is a maker of sulphuric acid, and will demonstrate that with a small quantity of that strong solvent the farmer can find out for sure whether he is buying bone or ground oyster shells and plaster. As Chairman of the Committee on Markets, I will say that we have had this matter of fertilizers under advisement, and will make some suggestions in our forthcoming report of abuses and frauds on the farmer.

TO PRESERVE MEAT.

Mr. M. S. Benjamin, of Clyde, N. Y., having imbibed the Jewish detestation of pork, has decided to rely on beef hereafter, and asked the Club how to keep it.

Mr. John Crane.—In the first place, the blood must be soaked out;

for this purpose, put it in weak brine for eight or ten days. Then make a brine of fine salt, and have it strong enough to bear up an egg or a potato. Add some saltpetre and some sugar, and scald the brine as often as a thick scum appears upon the surface.

Mr. Foster.—I happen to have a recipe in my pocket: To 100 pounds beef take nine pounds salt, two pounds sugar, two ounces saltpetre, two ounces black pepper; make a brine, and pour on hot. I first put the beef in weak brine to remove the blood, and in this way have kept it good into September.

Dr. F. M. Hexamer.—I have used the same recipe without the pepper, and find that it keeps the meat in excellent condition; when more salt was used it would be dry and hard.

Mr. Francis Collins, of Morrisville, Pennsylvania, contributed the following:—For every 100 pounds of meat (pork or beef), take four pounds of fine salt, four ounces of ground saltpetre, and one pound of common brown sugar. (This amount of salt will keep meat the whole year, if it is ordinarily fat, but it might take a little more where the meat is nearly all lean.) Rub the meat well, taking care that all parts have a good coat the first time. Lay the pieces on a board with the skin side down, sprinkling a little coarse salt on the board. As soon as they have taken in all the salt, rub again, but putting most on the flesh side. When the meat has taken in all the salt, wash the pieces off with a cloth wrung out of hot water.

Horace Greeley's Black Meadow.

The Chairman called attention to the fact that Dr. Hexamer, of New Castle, New York, a near neighbor of Mr. Greeley's, had brought from Chappaqua farm specimens of the swamp muck, and he asked the doctor to say something on the subject.

Dr. F. M. Hexamer remarked, that the specimens were from two fields of Mr. Greeley's estate, one lying along the margin of the hill, and the other lower down. They were both a portion of the original swamp, which has been thoroughly drained. The first received the wash from the high ground, and by aid of this mineral substance produced during the past season a really excellent crop of corn. The other field was covered with gravel, and thus the upward action of the water through the peat was accelerated, and a fine crop is the consequence. That so little earth as was added would make so great a difference, was hardly to be believed by those who did not witness the proof. I have seen, continued the speaker, such soil spoiled by

being plowed too deep. The only way to make such soil of much worth is to apply mineral substance. Any one who has soil of this character may try the experiment on a small scale, as this is one of the lessons Mr. Greeley's practice teaches.

Mr. P. T. Quinn.—I was at Mr. Greeley's recently, and he told me that he was fully convinced of the importance of deep culture in connection with underdraining, by the experience of the past season. The truth is, much of Mr. Greeley's corn grew on land as black as my hat, that has not had a shovel full of gravel thrown on it, and this corn was as good as the other. The land was all plowed ten inches and a foot deep, and while his neighbors were all burned up, he has made about sixty bushels shelled corn to the acre. Still, one of the members stated here not long ago, that Dr. Hexamer had said that Mr. Greeley's deep plowing practices would not do.

Dr. F. M. Hexamer.—I understand. The apostles of shallow culture want reinforcements, and have hastened to conclusions. I am not with them more than with the other extremists. I advocate the using of common sense everywhere, and always in farming. When land is light and mellow, I question the propriety, as a general practice, of going deep. Nature has subsoiled some sections, as, for instance, Salem county, N. J. If land is hard, plow deep, but go down gradually.

Pruning Trees.

Mr. S. Curtis, Pagetown, Ohio, having noted Mr. Quinn's advice to prune trees in winter, wrote to ask the whys and wherefores, and said: "I trim mine in June, or when the bark is loose. Trees thus pruned the past season, made more progress in healing the wounds made, than those that were made on the same trees early the spring previous, with two seasons' growth. Great care must be used in operation, so as not to bruise or loosen the bark; saw the limbs off with a fine saw; use a firmer chisel well sharpened, paring the wound made smooth and nice, as an old maid would trim her finger nails."

Mr. P. T. Quinn.—If any person were to ask me when to remove a large branch I should reply, without hesitation, in July or August, when the sap is active. But during these months farm work presses, and the orchard is likely to receive little attention. This being so, the work must be done before or after the hurry. I have never experienced bad results by using the knife and saw from February to mid-April, provided the wounds be left smooth and clean. To be

sure, the winter is not the best time, but it is better than no time, and the most convenient, if the weather is not extreme.

Mr. F. D. Curtis.—I paint the wounds with any common paint, which prevents rotting at the heart and assists nature in healing. I have felt like crying to see trees haggled and in other ways recklessly treated by neglectful farmers.

Mr. A. S. Fuller.—Don't call them neglectful, or they will be taking you to task as they did me when I made so bold as to say that they were "lazy enough." But to return to the subject, grafting-wax, applied hot, answers very well.

Dr. E. W. Sylvester.—Gum shellac dissolved in alcohol is better.

Mr. W. S. Carpenter.—I question the necessity of any application of this sort. Cow-dung is my plaster.

Mr. D. B. Bruen.—A salve made of one part shoemakers' wax, one part beeswax, and one part tallow is excellent.

Mr. W. S. Carpenter.—If one wants to kill trees let him apply tar in the form of wax, or in any other shape.

Mr. F. D. Curtis.—The best thing is paint. It does no injury, dries quickly, and does not daub like wax.

Mulching Strawberries.

Mr. P. T. Quinn.—In our severe and changeable northern climate, where one week the mercury goes down below zero and the next rises to fifty degrees, the largest crops of strawberries that vines are capable of producing cannot be grown without protecting the plants by mulching in winter. If the weather "sets in" cold early in the fall, and snow falls which covers the ground until spring fairly opens, then this snow forms an excellent mulch, and plants need no other protection.

Half hardy plants and vines will "winter better" when the cold is steady and uniform, than if the weather is mild with frequent changes. Raspberry and blackberry vines are frequently winter-killed on the south side of a board fence, while on the north side the vines are unharmed. Practical gardeners, when protecting half-hardy ornamental plants, will cover the sides of such plants facing south, leaving the half facing north exposed.

The alternate freezing and thawing, and consequent expanding and contracting of the surface soil, that injures the strawberry vines. Under these conditions the delicate surface-roots are broken off, and frequently, on heavy clay soils, from one-third to one-half of the

plants are "heaved out" by this expanding and contracting of the soil. It is not unusual to see large fields of young clover destroyed from the same cause. On close examination, it will be found that most of the roots of the clover are broken off a few inches below the surface. Any refuse material will answer for mulching strawberries; spent tan, hay, straw, leaves from the woods, leaf-mold, or long manure. In case the strawberry bed needs fertilizing, then a light coating of long manure, spread evenly over the beds or rows, will answer a double purpose. Each succeeding rain or snow storm will carry down to the roots of the plants the soluble portions of the manure, while the vines are protected by the mulch. If spent tan is accessible it will answer a good purpose, and the acid of the tan certainly improves the flavor of the berries. The other articles recommended for mulching may be applied when convenient, either before or after the ground is frozen. It is not necessary to put on a heavy coating; enough to cover the surface of the ground and foliage of the plants will be found quite sufficient. When leaves are used a little earth should be spread on top of them to prevent the wind from blowing them about. If the strawberry beds are clean, free from weeds and grass, then this mulch is drawn between the rows or hills in the spring, and left there until the strawberries are gathered. Practical strawberry growers find summer mulching quite as essential as winter. It keeps the weeds down, the surface moist, and the fruit free from dirt or sand.

Any person who took the trouble to notice the condition of strawberries coming from different sections to the New York market last season, must have observed that berries with grains of sand or dirt attached, brought less than the same size and quality of berries that were clean.

Adjourned.

January 11, 1870.

Nathan C. Ely, Esq., in the chair; John W. Chambers, Esq., Secretary.

Profit from Cows.

Mr. E. R. Wattles, Sidney, Delaware county, New York.—I have milked thirteen cows the past season. Two of them are two-year old heifers, and two three-year olds; the others varying from four to fourteen years old. I commenced making butter the sixth day of April; sold the first package the fifteenth; made and sold during the

season, beside what was consumed by the family of six persons, 2,600 pounds of butter:

Average price per pound, forty cents		$1,040
Sold also, seven calves		108
Two calves on hand		30
Fatted three hogs		72
Total		$1,250
Average income from each cow	$96 15	

My cows are grade Ayrshires; fed each cow two quarts cob meal per day for three weeks in the spring. Fed sowed corn from August 20th until September 15th. Are making now only fourteen pounds per week, as I feed nothing but dry hay.

Mr. J. B. Lyman.—On Saturday last, in the Philadelphia farmers' market, I bought these two balls of butter, for which I gave ninety cents. The Club will please note the color, smell and texture of this product. Gentlemen may have seen and tasted better butter. The price which this article commands is one dollar per pound. In the same market I bought this lump of fair butter for fifty cents a pound. From one of the best of those dairymen, I obtained the following

Statement of a Philadelphia Butter-maker.

I have no difficulty in making good butter all winter. I keep my milk pantry at fifty-eight degrees, as near as I can, and do not allow the mercury to go much either way from that figure. As spring cows approach the following winter, *i. e.*, when their calves are seven or eight months old, the butter comes much harder. For that reason I always like to have fall cows, so as to mix their milk with that of the cows who came in the spring. The food of cows makes a great difference with the flavor of the butter. I find clover hay cut and moistened, sprinkled with meal and wheat shorts, as the best food for making choice butter. It is also important that no weeds be mixed with the hay. Clover I find superior to timothy, or any other grass. I do not feed cabbages nor turnips, on account of the flavor. Cows differ greatly in their quality as butter-makers, and in selection I find it best to reject many animals that would be valuable in a milk dairy or a cheese dairy.

The Chairman.—We specially welcome such statements as this of Mr. Wattles; and regarding the letters sent to the Club, I have noted a change that has given me much gratification. We have very few, if any, communications now on the moon, on the reason why

some infants have thin skulls, or on the virtue of sorrel as a cure for cancer. We hear nothing of chilblains, of the noxious effects of tea, or the curse that follows the eating of flesh. The letters are strictly agricultural; they pertain to rural affairs only, and are eminently proper to read in a farmers' club. We are glad of farm statistics whenever we can get them.

Mr. F. D. Curtis.—In Saratoga county, the other day, a superintendent of a cheese factory told me that in the dairies represented at his establishment, the average product had been ninety dollars per cow, for the season.

Mr. John Crane.—I keep from twelve to thirteen cows, and my daughter, who is my clerk, informed me on New Years' day, that beside all we have consumed in the family, the income in money from milk has been, for the year 1869, $1,426, besides the value of three or four calves sold.

Market Abuses and their Remedy.

Mr. J. B. Lyman, Chairman of the Committee on Markets, presented the following report of progress: Your committee, in an endeavor to discharge the duty assigned to them of suggesting relief from certain wrongs and abuses in the disposing of farm produce in this metropolis, report that the subject is one of great embarrassment as well as of great importance. We find that the country supports a large army of brokers, go-betweens, agents or middle-men, who make sometimes a precarious living, and sometimes excessive gains by handling produce. In the matter of apples, as an instance, thousands of barrels come to the city and sell for two dollars and seventy-five cents and three dollars, or three dollars and fifty cents. They are repacked, and, after rejecting a few of the smaller ones, the most of what remains are sold at five dollars. We cannot but deem it an injustice that a few hundred men should make half as much, and sometimes fully as much, by selling the apple crop that comes to New York, as the thousands of anxious, hard-working farmers, who plant the trees, tend the orchards, pick the fruit, and send it to market. So in the article of butter. The up-town consumer pays from ten to fifteen cents, and often twenty cents, more than the butter brings at first hands. There are those who think these are matters of trade, and must be regulated by the laws of supply and demand. To show the fallacy of this position, we submit an instance from the practice of a neighboring city. This butter I bought from the

farmer who made it. He sells every week, on Wednesdays and Saturdays, at stand No. 555, in the farmers' market, Philadelphia. In that city there are no intermediaries, through whose hands the butter slides like the monkey's cheese, losing a nibble on one side and a bite on the other, till the farmer finds himself paid in skim-milk and the middleman in cream. If a farmer near Philadelphia makes such butter as this, he sells directly to the consumer. If his make commands a dollar a pound, as this does, he and not the merchant gets the benefit. Yet Philadelphia is a great city. The most of its butter is brought thirty, forty, and sixty miles to market. In handling some kinds of produce, there are practices which we cannot say are just or legal. For instance, when an article like rhubarb is sent, the handler has been known to cull the lot, sell the choice at twenty and twenty-four cents a package, get rid of the leavings at sixteen cents, and return sale to the farmer at sixteen cents for the whole. The practice of returning to the farmer only what the smallest or poorest of a lot has brought, is quite common. The farmer can get about as much for a second-rate article as he can for a choice product, because the middleman generally pockets that difference, and says nothing. On the other hand, there are foul practices which cannot be sufficiently roprobated; farmers who fill two-thirds of a barrel with small apples and top out with big fruit; men who put old butter at the bottom of a tub, who water milk and dilute vinegar. This we reprobate just as much as we do the grasping and trickery of non-producers. Farmers often, very often, ship to a man who does not make it a business to dispose of the article sent. For instance, butter is shipped to a flour merchant, eggs to a fish dealer, poultry to a potato man, or cheese to a hardware house. There is no cure for this but information on the part of the farmer. Large dealers, and those who live near, generally obtain this knowledge; but those who live afar, who read our weekly paper, and work hard, who must make every edge cut and every ham tell, whose farms are carpeted with mortgages, and whose families are large, how can they be expected to know all the ins and outs of New York, all the tricks of trade, all the wiles of the adversary? I have heard of an instance which will illustrate the machinations that are set for the unwary step. A farmer from New Jersey, some years ago, came into the New York market, and, by honest deal, built up a wide business. Evil men envied him, and conspired to recommend as a bookkeeper a man of singular ability in forcing a balance, no matter

what the figures might be. It worked, and the honest Jerseyman was shorn of his hard-won thousands, while the ring chuckled. Such are some of the abuses in the New York market system. Your committee has no sure cure, no patent medicine for these ills. But we wish to fix the attention of farmers to the subject, that they may combine for their protection. We recommend: 1. A thoroughly honest packing on the part of the producer; no decayed potatoes with the sound; no frowy butter in the pail with good; no light weights; no weeds in clover hay; no thick plank at the bottom of the half-bushel. Let the farmer inform himself as to the houses that make a special business of handling what he has to ship, and be reasonably sure of their solvency and good repute. 3. Your committee recommend that farmers form clubs in every considerable village, and send their most vigilant and capable man, paying his car fare, if necessary, and requesting him to inform himself accurately of the best men in the produce and marketing business. 4. There is need of some bureau or committee, or commissioner of some description, whose business it should be to give such representatives of farmers' unions the information they need. In a city where it is reputed that every man has his price, where offense's gilded hand may shove by justice, the farmers may find it difficult to secure a friend too keen to be hoodwinked, not afraid to speak a wholesome, though unwelcome truth, too lofty to soil his fingers with a percentage; but the producing class of this country *need* such friends more than they need a senator or a minister to the court of St. James.

The Chairman.—This report is not final. The committee on markets will continue their good work and show up all the wrongs and mischiefs of our system. We hope they will in their wisdom hit upon some happy exit from all our troubles.

Mr. Thomas Cavanagh.—I hope they will make an effort for the repeal of an unjust law made in the interest of New York middlemen, which authorizes the police to order the farm wagons out of our streets after eight o'clock in the morning. Another rascality that ought to be shown up is this. If a boat comes to the wharf with a good cow or a good lot of produce on board, some runner will get on deck and engage his article at a fair figure. Then the owner will refuse genuine offers till the market grows dull. At last, after waiting half a day for the "gentleman" who first spoke, he sells low, and goes home quite beat out with the evil practices of this bad city.

Barley.

Mr. F. D. Curtis.—On behalf of one of my neighbors, I would ask whethor barley is a profitable grain to feed to sheep.

Mr. J. B. Lyman.—One of the best grains farmers in the country, Mr. Geddes, says that barley is not a good grain for work stock, but it will make hogs and mutton sheep take on flesh about as fast as any other feed.

Oats.

Mr. Wm. Newton, of Henrietta, N. Y., wrote that some four years ago he received from Germany a quart of "White Probsteier" oats. The past season he sowed a field of six acres with this variety, and harvested 587 bushels, or an average of nearly ninety-eight bushels to the acre, weighing thirty-nine pounds to the bushel. He further said: "I notice in nearly all the large yields of oats reported, that returns are given for only a small quantity of ground, which was prepared with extra care, well manured, and only a small quantity of seed used. Farmers are often advised to use less seed than they do. Now, I think this advice is wrong, and will result in loss to most that follow it. If our lands were as rich as they should be, less seed might be required. But not one farm in a hundred is in this condition, and we must look at things as they are, and not as they should be. I believe nine out of every ten farmers fail in raising large crops of oats by not using *seed enough.* I sowed broadcast, at the rate of three and a half bushels, by measure, per acre, and the result was as stated above. The soil on which they grew is a loam; the timber originally beach and maple. The preceding crop was corn. About one-half the field was manured in the fall, before the corn was planted. The oats received no manure of any kind. One land in the field was sown at the rate of about two bushels per acre. It was not thrashed separately, but I should judge the yield to have been from seventy to seventy-five bushels per acre. The oats on it were three or four days later than the rest of the field, and some were rusty, while the other showed no sign of rust. This I noticed before. Last spring I let my brother have seven bushels of the oats, which he sowed on two acres. The yield was 201 bushels from the piece. Last year I sowed at the rate of three bushels per acre, and the yield was at the rate of seventy bushels per acre. I was convinced by the appearance of the field that had I sown one-third more seed I should have harvested nearly one-third more oats. We have

heard from those that have used small quantities of seed. I for one, would like to hear from those that believe in heavy seeding; not the result on a few square rods of ground, but the average of several acres. I had a small piece in my garden planted (not sown) very thin. I cannot give the exact yield as part of the crop was destroyed before being gathered, but it was probably somewhere between 150 and 200 bushels per acre. I do not consider this any guide, as I have not the manure, nor can I obtain sufficient to make my farm as rich as my garden. These oats have a very thin hull, and were awarded the first premium at the New York State Fair last fall for this reason. I send you one-half bushel (sixteen pounds). They are a fair sample of the oats. I think their appearance will show they have not greatly deteriorated in the four years they have been raised here.

The Chairman.—I have requested our Secretary to put these oats up in quart parcels and distribute them at the next meeting, and I hope they will be fully tested and reported on next season.

The Secretary.—Here is a specimen of "Surprise oats" forwarded by Mr. George Goddard, of Port Jervis, N. Y., but grown in Chickasaw county, Iowa. I have put them on the test scale, and find that they weigh at the rate of forty-three pounds per bushel.

Mr. Adrian Bergen.—In this connection I would like to be informed why oats raised on rich soil are so likely to lodge.

Prof. J. A. Whitney.—In rich land, commonly so called, there may be an excess of ammonia in proportion to the mineral elements of plant food. When this is the case the green parts of the plant will have a rapid growth, but when the plant begins to ripen, a greater proportion of phosphoric acid is needed for the kernels, together with potash and soluble silica to give stiffness to the straw. The silica is seen in ripe straw in the glistening coating. The use of wood ashes and mineral superphosphates would doubtless remedy the difficulty.

Mr. J. B. Lyman.—Experiments were made by the New York State Agricultural Society which tended to show that it is to the interest of every farmer to try salt in such cases. There is no positive knowledge beforehand that it will bring the desired result, but it is likely to three times in four.

Prof. J. A. Whitney.—Salt is found to be an excellent fertilizer in some cases, but in others, apparently identical, it has failed. It can act in two ways by its gradual decomposition in the soil. The

chlorine, it is assumed by some, will hasten the germination of seeds, and the soda is an element of plant food which is often exhausted on lands by excessive cropping. In all soils when the straw is long but weak I say *try salt.*

Analysis of Earth from Westchester County.

Some weeks ago Mr. Lawton of New Rochelle, brought a specimen of moist blue earth, and asked the opinion of the Club as to its value as a fertilizer. It was referred to Prof. Whitney, who reports as follows:

The material is not a marl, as was thought by some when it was brought before the Club. Almost wholly destitute of lime, it is as far as possible removed from shell marl, so called, and the nearly total absence of potash makes it so far below green sand, that no comparison can fairly be made between them. The presence of a noteworthy portion of phosphoric acid would give it some value as a fertilizer, were it not that the acid probably exists in the form of an insoluble phosphate of iron. The material might be used to advantage on light and porous lands, to give greater consistence to the soil, in the same manner that clay has been used for the same purpose. In this case, the slow dissolution of its phosphoric acid would, in the course of years, add appreciably to the fertility of the soil to which it was applied. It cannot, however, be called a manure in any proper sense of the term, or used as a substitute for marl which has a far different origin, and many times as much of fertilizing constituents.

Mineral Manure for Grain.

Dr. S. J. Parker, Ithaca, N. Y.—There is a bed of mineral manure, immense in size, a few miles from the farm of our friend Geddes of Onondaga. I have often thought I would suggest that it be made available; especially as that wonderful wheat field of Mr. Geddes, which for two generations seems so inexhaustible, is over it. I mean the mixture of lime, gypsum, and the remnants of the action of common salt on the gypsum, lime, and alumina, in the escapements by the side of the railroad in the town of Camillus, and near Marcellus, a few miles north of the farm of Mr. Geddes. He, if I mistake not, has often spoken of these deposits of the "Onondaga Salt Group" as the scource of the fertility in his farm. Why not establish mills, grind these millions of tons of material, fertilizers now lying idle, and at a reasonable value sell them, for the purpose

of being annually scattered over wheat farms, to increase their fertility? At least two miles of this rock, which is very soft, and easily pulverized, lie open in the boundless valley, through which flows a large stream of water, for driving the grinding mills. It may be that a company with a few thousands capital might find the manufacture and sale of this natural manure profitable to themselves, and a great gain for wheat lands. I have often asked why such ground material would not do artificially just that which naturally it does for Onondaga wheat fields.

Mr. F. D. Curtis.—Gentlemen should remember that only a few elements in manures will ever pay a farmer for expensive handling or distant transportation. Ammonia is of great value, so is phosphate of lime and nitrate. But when we speak of sulphate of lime or plaster, if combined with heavy inert stuff, it will not pay to dig and haul far. Pure quicklime, pure gypsum, and pure salt have a certain value, which may be ascertained, as applications to land, and a rock or marl which is believed to contain them may or may not be a profitable manure according to the value of these elements when pure. But the only precious things in fertilizers are ammonia, phosphorus, and potassa.

Dr. Isaac P. Trimble.—I am glad of these pertinent remarks of Mr. Curtis. We need nothing so much as trustworthy information about fertilizers. The Secretary has a small package of fine bone meal from the mills of Lister Brothers, near Newark, N. J., to which I ask the attention of the Club. It is so fine that it acts at once; it is, I believe, the quickest as well as the strongest application that can be made to young or backward plants.

Mr. D. B. Bruen.—I have known those Listers, father and sons, for a generation, and I do not believe they adulterate.

Mr. Russell.—I should be only too happy to have members of this Club visit the Lister Brothers mill. They will see that we are receiving and grinding up good raw bones from hotels and houses in this city at the rate of thirty tons a day.

The Chairman.—If there is anything in smell this powder has strong recommendation. I hope this matter of pure and impure bone will again come before us, and also that it will not escape the scrutiny of this committee. If there is a fundamental material interest in society it is right here. The farmers, above all other information, want to know when they buy what purports to be 200 or 2,000 pounds of ground bone, not only that it has some fertilizing

power, but that a fair and only a fair profit has been made by the grinder, and that the article is whatever it claims to be. Nor is it farmers only who are interested. The price of fertilizers must regulate the price of food, except on fresh soils; the price of food regulates comfort, prosperity, virtue itself, for virtue is largely dependent on thrift. It is of prime importance that the deception alluded to be investigated and the truth made known.

Cranberries.

Mr. R. Tucker, Princeton, Wis.—I wish to put out two or three acres of cranberries. What is the best time of the year for setting? Will the vines grow when there is no root attached, properly covered? How far apart should the rows be set? Is it best to take the turf off or cover it with sand? Should they be overflowed in winter? Should the sand be put on before setting or after, or not at all? How near the top surface should the water be kept during the season of growing?

Mr. A. B. Crandell.—It does not make much difference as to time of the year; spring is safe; fall is more convenient. The vines will grow without roots, but not as well. Eighteen inches or two feet apart; the turf should be taken off and the black muck be well covered with sand. Overflowing in winter is important; in summer the ditches should stand half full. The sanding is done before the vines are set. The whitest and most barren of sand should be used; such as masons select, or such as glass-blowers buy, is preferable.

Making Hot-beds.

Mr. P. T. Quinn.—Those who enjoy the luxury of home-grown and early vegetables, should not fail to make the necessary preparations in full time, so that the kitchen garden will be well stocked with such kind of plants, the seed of which have to be sound, under glass. The intelligent market gardener seldom needs reminding, nor specific directions how to make or manage a hot-bed, for this is one of the first lessons that every gardener has to learn, before he can pursue his calling with any hope of success. Farmers as a general rule, pay little attention to this part of their business. It should be the business of every farmer who is alive to his own interests, to have a well kept and well stocked kitchen garden. The only outlay will be in purchasing the sashes, and these will last a dozen or fifteen years, if they are kept under shelter when not in use.

Location.—Select a south-western exposure, protected from the north wind by a board fence, hedge, or the side of a building. Then excavate the ground eighteen inches deep, eight feet wide, and as long as required, allowing three feet for each sash.

Making the Beds.—Gardeners in the latitude of New York start their hot-beds from 1st to the 15th of February. When started early more manure is used, so that enough of bottom heat is supplied to keep the young plants growing until mild weather sets in. Commence in the chosen position by putting on a layer of cold horse manure six or eight inches in thickness on the excavated surface. Begin at one end of the intended bed, and be careful that the first layer, as well as all succeeding ones, are spread evenly. Then add a second layer of hot manure about the same thickness as the first. The mass may then be trodden down by walking on the top of the manure, keeping the feet close together. Another layer of hot manure may then be put on, and the frames placed in position, and pressed down firmly. Then add another layer of fine manure ten or twelve inches in thickness inside of the frames, to finish with, when the sashes may be put on.

The beds being eight feet wide and the frames only six, there will be a margin of twelve to sixteen inches outside, which should be banked up with manure as high as the top of the frame.

Frames.—These may be made with common boards nailed together, with posts in each corner for support. The frames should be five feet ten inches wide from front to rear, and as long as desired; the front board twelve inches high, and the rear eighteen to twenty-four. The frame when made should stand level on the bottom, forming an inclined plane on top, so that when the sashes are put on there will be enough of fall from rear to front to cast the water readily.

Cross ties six feet long, made of narrow strips of boards, one by three inches, should be morticed into the front and rear boards of the frame every three feet. These will support the sashes and strengthen the frames.

Sashes.—These can be bought from any sash manufacturer. They should be well constructed with seasoned wood. If not, the heat of the beds will warp the wood, displace and break the glass. The narrow lights of glass, four by six, are preferable. These should be cut curved on the lower edge, so that the water will run off in the middle of the light in single drops, and not form lenses, which would be likely to scorch the plants.

Putting on Earth and Sowing Seed.—When the beds are furnished as stated before, the sashes are put on at once. These are covered with straw mats. In case the weather is pleasant, the latter may be taken off for three or four hours, the next day. Two days from the time of making, under ordinary circumstances the earth may be put on. This should not be done, however, until the manure is well heated inside of the frames. Six or eight inches of leaf mold in good garden soil, free from stones, will answer.

Two or three days from the time of putting in the earth the seed may be sown. Select a pleasant spot, and remove all the sashes and mats. Unless the soil is very rich, a handful of bone flour or superphosphate should be sprinkled over each light. Then turn the earth over with a digging fork, and rake the surface level; for if left slanting the frequent waterings will wash the seed from the upper or rear part of the bed.

Make shallow drills from rear to front two inches apart and about three-quarters deep. The seed is sown in these drills, and covered lightly by sifting earth over the bed until the surface is level again. Each kind of seed should be sown separately, and labeled at the time of sowing. The sashes should then be replaced, and toward night the mats put on. Except in very cold weather, the mats should be taken off daily, about nine or ten o'clock in the morning.

The secret in growing strong, stocky plants is, when they are up to give an abundance of air at the right time. For instance, if the sashes are opened soon after removing the mats, the chances are that the young plants will be injured by what gardeners call "damping off." While the plants are young no air should be admitted into the beds for at least one hour from the time the mats were removed, Each succeeding mild day more air can be given to the plants, to keep them from growing spindling.

Egg plants and peppers require more heat and less air than cabbages, cauliflowers, tomatoes, or lettuce.

When tomato plants are two inches high, they should be pricked out into another frame. Those who make a business of growing tomatoes in a large way for market will transplant them three times before setting them out in the field. Each time the plants are moved from one bed to another, more room is given in order to get a short, stocky plant.

Egg plants will do better, producing more fruit and earlier, where

transplanted or put in "thumb pots," and placed in beds made like a hot-bed, only using less manure.

The following list and quantity of seeds, if fresh and sound, in the way described, will give an abundance of plants to supply a family of twelve persons with plenty of vegetables: one-half ounce smooth round red tomato; one ounce New York improved egg plant; one ounce squash pepper; one-half ounce half early Parish cauliflower; one-half ounce early Wakefield cabbage; one-half ounce flat Dutch cabbage; one-fourth ounce curled Silesia lettuce; six Kohl-rabi, or turnip-rooted cabbage.

There are few neighborhoods where enough plants cannot be sold to more than pay the expense of making and caring for the bed.

When the young plants are taken from the seed-bed, cucumber and melons can be started under the glass and transplanted in the open air in May. These plants will produce fruit three weeks before seed planted in the open ground.

Adjourned.

January 18, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

EGGS—HOW TO GET THEM AND HOW TO KEEP.

Mrs. E. Trimble, Wheeling, Va., has tried various ways but prefers the method by lard. She coats the fresh eggs with cold, sweet lard, and puts them away in a stone jar, little end down.

Prof. J. A. Whitney.—Some years ago an account was published of a French method of keeping eggs, which was on the same principle. The eggs were rubbed with fresh butter until the pores were all filled. It was said that if a spot the size of a pin's point were left untouched the egg would spoil. There are only two things essential to the keeping of eggs; these are to keep the air out and to maintain a moderate and uniform temperature. Many different ways of coating eggs have been proposed, including shellac varnish, which is not good for much, and soluble glass, which is not worth anything for the purpose.

Mr. D. B. Bruen.—I have stated here, on more than one occasion, that my wife keeps eggs eight months or more by packing in fine salt, little end down.

Dr. Isaac P. Trimble.—These processes are all well enough for those who have no facilities for keeping poultry, and thus securing

their own eggs; but those who keep hens had better treat them in such a way as to have fresh eggs all the year round.

Mr. J. C. Thompson.—That is what I think. I myself am never without fresh eggs; and a neighbor of mine, a cute down-easter, is even more successful. His plan is to hatch very early and get some months of good laying time from a pullet before she begins to moult. When any pullet begins to moult he takes her head off, and has younger fowls to carry on the good work.

Lime on Certain Soils.

Mr. David Petit, Salem, N. J.—The application of lime to some land I have found of but little or no benefit, while it has incrased the fertility of other land to a remarkable extent. This benefit, or increase of crops by liming, depends very much on the amount of organic and inorganic matter in the soil, with which lime combines, or forms soluble compounds. The following are analyses of mud or tide deposits in Salem county. These are valuble and productive soils, noted for their enduring fertility. They are also repositories of vast stores of fertilizing materials for improving the upland.

	1.	2.
Silica	63.50	50.65
Alumina	13.53	13.00
Protoxid of iron	5.05	4.27
Lime	.34	.53
Magnesia	.90	.97
Potash	1.48	1.40
Soda	1.14	.89
Chlorine	.12	.20
Sulphuric acid	0.30	.29
Phosphoric acid	0.64	
Organic matter and water	10.25	23.03
Hygroscopic moisture	2.86	5.76
Total	100.12	100.99

Here we see a very large proportion of organic matter, amounting in one instance to twenty-three per cent. On this kind of land, lime has been very beneficial. Report has been made to our Salem county Farmers' Club, that Edward Buzby raised 1,200 bushels of wheat on forty acres on such land by liming; and Chas. Harmer had 370 bushels from ten acres by liming alone, or thirty-seven bushels per acre. The fertility of this land can be kept up for a long series of years by liming alone, and with very shallow plowing. An amount of lime

that would ruin upland for years, would only increase the fertility of such land. Wm. G. Woodnutt reported to the Club that he plowed up one-third of an acre, and spread on it 900 bushels of slaked lime, or 2,700 bushels to the acre, with a view of making a compost for other land; and, as he had not time to remove it in the spring, was advised to plant it with corn. He did so, with the eight-rowed flint, and said he had never seen such large and dark green corn of the kind grow anywhere else as grew on that piece of limed meadow mud: as large as the large varieties grow.

The Import Duty on Blooded Stock.

Two weeks ago a letter was received from a Pennsylvania correspondent, praying the Club to take such action as it was hoped would have influence in inducing the government to remove the heavy tariff on imported stock. The subject was referred to Mr. Frank D. Curtis, Vice-President of the State Agricultural Society, who submitted the following report:

I find upon examination that "animals," meaning farm animals, were formerly imported into the United States free of duty. Under the necessity for a large revenue to meet the increased expenditures of the government, a duty of twenty per cent was required on all imported stock, and no discount or drawback for societies or individuals. I suppose the Department of Agriculture at Washington might import a small amount of stock and have the duty remitted; at least such has been the case with the customs duties thus far of that department by the accommodating Secretary of the Treasury. The value of the imports for the past few years are as follows: Year ending June 30, 1866, $1,670,837 (most of the importations for this year were free); 1867, $1,960,472; 1868, $2,352,249. The amount of duties paid on the importations of 1867-68 was $862,544. The Agricultural Department at Washington have been trying to do away with this tariff. Early in 1868 the commissioner sent a communication to the congressional committee on agriculture favoring the policy of admitting thorough-bred animals for the improvement of farm stock duty free. The commissioner nor the committee have yet succeeded in obtaining this abatement. At a later period the Hon. Calvin T. Hulburd, as the representative in Congress of a portion of the great dairy district of New York, together with Gen. Capron, endeavored to obtain the repeal of, or at least a reduction of, the twenty per cent duties on dairy cows. The argument in favor of

this change was that the production of butter and cheese in this country could be vastly increased, thus adding to the wealth of the nation, if the farmers upon the other side of the border should grow the calves and raise the cows until they became productive machines, and thus relieve our own dairymen from the profitless trouble and necessity of growing their own cows. This improvement would, doubtless, have been adopted had not our legislative fathers loaded down the idea with local and personal measures which crushed it to the earth. This propensity to saddle schemes that will not stand alone upon more popular and praiseworthy objects, until they, too, fall by their muchness, is not a new characteristic or practice of legislators. Now that the country is blessed with the full fruition of peace, and laws are made to lessen the burdens of the people and stimulate the expansion of its material interests, the improvement of live stock should come in for its share of public attention. In my opinion, the importers and breeders of thorough-bred stock are entitled to be considered public benefactors, and to urge their cause is both right and just. The government should remove a tax which is but a very small part of the great aggregate income for the treasury, but an onerous burden upon those who are willing to venture their capital for the public good; for thousands of dollars have been sunk by the importer where one has been made. At least twenty-five per cent would be added to the value of our neat cattle and to the size of the bodies of our sheep, a point in which American sheep eminently fail, by a liberal infusion of foreign blood; but the high tariff and the risks attending importation, coupled with the original cost, must necessarily cause the price of thorough-bred stock to be beyond the means of the great mass of American farmers. If the twenty per cent could be abolished, a healthful and vigorous impulse to importation and breeding would be created, and in a short time thorough-bred animals would be universal. At present but little stock is imported beyond what is required to keep up the character and blood of our select flocks and herds. "Of course," says one of our leading stock men, "it is to our advantage as breeders, having established our herd, to keep on the present duties, as they act practically as a prohibtion, and parties, who would otherwise import now come to us, consequently prices are higher than they otherwise would be for first-class animals." It is for the great public we would speak; and if we must have a duty, let it be specific, and not *ad valorem*, which acts as a direct preventive to purchasing abroad

the highest priced animals. In Canada a more liberal spirit exists. The Provincial Agricultural Society trebles the premiums when won by a male which has been imported from Europe during the previous year, and doubles them when the successful prize-taker comes from the United States. Under the fostering care of her societies and generous laws, enterprising citizens of the dominion have pushed the standard of Canadian stock to the foremost rank. There is an awakened spirit among the husbandmen of the country. Agricultural papers, which the farmer should prize next to his Bible, are multiplied and sustained. Better tillage follows the footsteps of the laborer. The home is much more attractive. Improved animals are demanded for the shambles, the dairy, and to ornament our fields. Let Congress catch this spirit of progress, and be in harmony with the advancing strides.

Mr. J. B. Lyman.—The cattle market reports, when compared one year with another, do not show the advance in size of bullocks that we might expect. There is enough short horn blood in the east to make the average weight of animals from Ohio and New York greater than it was; but we have a great number of small beeves from Texas. This will continue till we can make a fine English bull less a luxury, in which the millionaire only can indulge. The President of our State Society, who now has the finest herd in New York, gave this year a thousand guineas for a Bates-Durham bull in England. The import duty was more than $1,000. Of course, he must have fancy prices for the progeny of such an animal. If the requirements of our farmers were properly presented by the Committee on Agriculture, the present Congress might repeal or reduce the impost. With a view to such action, I offer the following:

Resolved, That Congress ought to repeal the duty of twenty per cent on stock imported for breeding purposes, and that a committee be appointed by our Chairman to prepare a memorial to Congress setting forth the requirements of the case, and the reasons for a repeal, or an important reduction of the duty.

Messrs. Lyman, Curtis, Reade, Bragdon and Crandell, were named by the Chair as the committee to prepare such memorial.

Gas Lime as a Fertilizer.

Mr. J. H. Churchill, Feeding Hills, Mass., would like to know if it will pay to cart gas lime six miles, and, if so, what soil is it best adapted to, and what is the proper way of applying it.

Prof. J. A. Whitney.—If the gas lime can be had for one-half the price of ordinary lime, it will pay to cart it six miles. It should be exposed to the weather for some months before being used. This will enable the sulphur and sulphites, which are hurtful, to be converted into sulphates, which are harmless and beneficial. It may be spread on the land then, say sixty or seventy bushels on an acre.

THE VALUE OF WOOD ASHES.

Mr. C. H. Coan, of New Lyme, Ohio, desired to be informed whether he had better sell his wood ashes for eight cents per bushel, or say no to the person who offers that price, and scatter them upon his fields.

Mr. F. D. Curtis.—Ashes, unleached, are worth at least twenty-five cents per bushel. Many pay much more, and do not grudge the outlay.

Mr. H. L. Reade.—The value of ashes is not sufficiently understood. Several years ago, before plowing in the spring, I raked the potato vines on a certain field into winrows, and burned them. The crop of oats on these particular lines, was twice as large as on the land five feet distant; and the yield of grass was nearly twice as large for at least three years. I have bought ashes at eighteen cents a bushel, carted them eight miles, and consider them the cheapest of all manures.

THE CURRANT.

Mr. P. T. Quinn.—Among the last known as "small fruits," which have been cultivated for market with a view to profit, the currant has not, until quite recently, received the attention it well deserved. For a dozen years past, the popularity of the currant as a table and dessert fruit has steadily increased, and it is destined to become a general favorite with consumers. The subacid flavor of the cultivated kinds is agreeable to most persons, and considered by all as a healthy sauce to any feast, especially in midsummer.

To the practical fruit grower, the currant possesses special characteristics, which are worthy of thoughtful consideration. Take, for instance, the strawberry, and, when ripe, two days' rain often spoils one-third of the crop, and of course lessens the profits to that extent. With the currant the case is different. The fruit has a season of six or eight weeks, and even, when fully ripe, two or three days' rain does not injure the fruit, the storm simply stops the "pickers"

while the rain is falling. During the season, if the price of currants fall below a certain figure, the grower can turn his crop of fruit into jelly, which is a merchantable article, kept on sale at the present time by every first class grocer.

Uses.—When green the currant is made use of for pies and tarts. When the fruit is ripe, the bulk of the crop is sold to manufacturers of wine and jelly. The demand for table use has increased rapidly within the last four or five years; and this demand will be more each succeeding year. I know of many instances where families that six years ago hardly knew currants, that for the past two seasons have had them on their tables three times a day as long as the fruit lasted.

Propagation.—There are none of the small fruits more easily propagated than the currant. In the northern and middle States the currant ripens its wood in the latter part of August. When the wood is ripe, the surplus may be cut from the parent bush, and made into cuttings about six inches long, cut square on the lower end, and obliquely on top. These cuttings may be planted at once, in well prepared ground, in a narrow trench five inches deep and as long as required. The cuttings are placed in an upright position two or three inches apart in the trench. In filling in the trench, the earth should be pressed very firmly around the lower end of the cutting. This can be done with a wooden pounder or by stamping the earth with the feet. It is important to do this in planting all kinds of cuttings, as well as the currant. When the loose earth that was taken from the trench is replaced, and surface leveled, two eyes of each cutting should be above the surface.

When the cuttings are made and planted in September, young roots are pushed out. Soon after planting, and before cold weather sets in, the cuttings are well rooted. At one year from the time of planting the young plants will be as strong as the year-old plants, when the cuttings were set out in the spring.

Culture.—The currant will grow in any soil that is properly fertilized, but will do best, making more wood and producing larger fruit, on a well prepared clay soil. It is a rank feeder, and will produce beautiful crops annually, when the soil is kept rich.

When the ground is prepared, the rows may be marked out four feet apart, and the plants set in the row three feet. This will give ample room for cultivating, gathering the fruit, etc. Like the pear, the currant is social in its habits, and will do better with close planting and careful pruning. The main object in pruning the currant

bush is to keep the surplus, young and old, wood thinned out and shortened in, so that the bush will be open and spreading. If the young wood is permitted to grow up in the center of the bush, the fruit on the inner branches will be small and inferior.

A neighbor practices an excellent method of pruning on his bearing bushes. Instead of waiting until the end of the growing season, when the wood is ripe, he removes the superfluous young shoots in the early part of June, nipping them all with the thumb and finger. By this simple and effective method the labor and expense of pruning is reduced, and the yield of fruit is very much larger than when treated in the ordinary way. To insure paying crops of fruit it is quite as important to give the bearing currant bush an annual pruning as it is the grape vine, although the currant will stand the "rough and no treatment" system better than the grape. In most cases the grape vine will receive some attention during the year, in the way of manuring, digging around the roots, &c., &c.; but I have known many instances when currant bushes were allowed to stand in a neglected part of the garden for five or ten years without manure or cultivation, and still bear some fruit every year.

Varieties.—For many years the general favorite, the Red Dutch, was the only red currant cultivated to any considerable extent in this country, and it was principally grown in gardens for home consumption. The introduction of the Cherry and La Versaillaise at a later period gave an impetus to the culture of the currant on a large scale for market. The large size of berry of both of these sorts attracted the attention of fruit growers, and as a matter of course they were propagated, and planted extensively for market. For a number of years there were little or no demand for plants of the Red Dutch. Every one who planted wanted the large kinds. However, when the excitement subsided, and growers compared notes, under the same treatment, the Red Dutch was found nearly if not quite as profitable as either the Cherry or La Versaillaise. There is very little difference, if any, between these two last named varieties, either in growth, size of berry, or length of bunch. The quality of the La Versaillaise is bitter, and the bunch more shouldered than the Cherry; but when the two kinds are placed alongside of each other on separate plates, good judges of fruit are puzzled to decide the difference. There have been a number of new varieties introduced within a few years, but their culture have been very limited. Of white currants, the White Grape is the most popular with growers. In another article on this

subject, I will give some figures showing the profits of currant culture.

CONOVER'S COLOSSAL ASPARAGUS.

Mr. H. Wainwright, of Farmingdale, N. J., has heard a great deal about a new variety of asparagus bearing the above name, and he is anxious to know if these stories are all true, and, if so, where the seed or plants can be obtained.

Dr. F. M. Hexamer.—The variety has been but one year in market, but it is certainly something quite extraordinary. The plants grow twice the size of the common sorts, and the flavor is not excelled. If it continues to do so well, it is certainly a great acquisition.

Mr. P. T. Quinn.—I indorse the statement, and add that I found the yield fifty per cent larger than that of the varieties cultivated heretofore. Mr. Conover is in Washington Market.

Mr. J. C. Thompson.—But it should be borne in mind that the Colossal must not be crowded. Plant it three and a half or four feet apart, and remember that, like all asparagus, it must have plenty of manure.

BONES.

Dr. J. V. C. Smith.—Gave the Club a very interesting lecture, showing how bones grow. The conclusions valuable to the farmer that may be drawn from his remarks are: 1st. That all young animals, even those in utero, should have an abundance of bone-making food. 2d. That raw, unboiled bones, are much the strongest, and the prompest fertilizer on account of the glue combined with the lime. 3d. That muriatic and sulphuric acids will melt bones, and the liquid thus obtained is a strong fertilizer, but should be much diluted and mixed with peat or clay.

Adjourned.

January 25, 1870.

NATHAN C. ELY, Esq., in the chair; JOHN W. CHAMBERS, Esq., Secretary.

RAISING CALVES.

R. P. Goodall, Colton, N. Y.—I feel like boasting a little about my calves. I raised only two, but on them I made more than three or four of the usual size. I fed on new milk a few days, no longer than it was necessary to learn them to drink. Then they

were fed on sour milk, with nothing else but grass. I fed them all they would eat without scouring too much. If they did scour I gave them rennet. I think, among other things, I have proved this, that calves ought never to be fed together. Each should have a mess separate, as no two drink alike. Some drink faster than others, therefore get more than is for their good, while the others do not get enough. I think it pays to watch them closely, and see that they get just enough and no more.

Dr. Trimble.—In some experiments with calves on my place, the hired man who had charge of them, forgot to feed one in the morning, and thought he would make it all right by giving double quantity at night. He did so, and the calf died, a result which proved that the creatures will eat more than is good for them, and that, as the writer of the letter remarks, they need watching.

SALT FOR STOCK.

Mr. D. M. Judd, Drayton Plains, Mich., wrote to say that the discussions on this subject called to his mind an incident of an expedition made several years ago under Lieutenant Hernden, of the United States Navy. The expedition started on the west coast of South America, and when near the center of the continent, where grass was the most luxuriant, the cattle and horses were afflicted with weakness, would stagger and lie down, and could not get up. They would draw themselves about, and eat off everything within their reach, until they could draw themselves no farther, and would die of weakness and starvation, the appetite holding good to the last. The lieutenant said he could discover no cause for this strange disease, except the want of salt. There was no salt springs or "licks" in the country, and it was so far inland that the sea breeze did not reach it, and no way of getting salt except by a long up-stream water communication with small boats.

Mr. R. L. Lamb, Ransomville, N. Y.—Two years ago last April, two calves were dropped in my yard. I gave them good ordinary keeping, feeding not more than one bushel apiece of meal up to the age of one year, and not a particle of salt. At this time many, who had never thought otherwise than that salt must be given at least once a week, on seeing my yearlings thought them equal to many of twice their age, and that I might take a premium upon them at a town fair. About the first of June last they dropped calves, very strong and large. I have milked them, as also an older cow, during

the past season, none of the three having a particle of salt, save what their Creator combined for them in their natural food. Besides supplying milk, cream and butter, for a family of four persons, in which no lard is used, as we do not patronize the hog, and fattening one calf to the age of nearly five weeks upon new milk, they have made 400 pounds of butter, most of which has been sold, and never a pound for other than first-class butter. I will remark that for the two years past I have followed the same rule with horses and sheep, and with equally satisfactory results. For six years I have myself adopted the same rule as far as it is possible to do so in society, and I am acquainted with scores, and I may say hundreds, of those who have done the same.

Mr. F. D. Curtis.—Such exceptional experiments do not establish a principle or prove a case any more than the experiment of a neighbor of mine who kept a cow some months without water proved that water is unsuited to animals, and that they thrive better without it.

Mr. Thos. Cavanagh.—I have horses which, because of carelessness, have had no salt for four years, and yet I am convinced it would have been better for them had they been regularly supplied. My neighbors keep a chunk in each manger, and I am afraid they would make rather a better show on the avenue than I could, although in quality of stock, or in cost of keeping, they are not ahead of me. Of course, the merely isolated cases cited by our correspondent prove nothing.

APPLES.

Mr. W. W. Houseman, Batavia, N. Y.—This fruit has become a leading feature in our agriculture in this region, The varieties mostly cultivated are Roxbury Russets, Greenings and Baldwins. They are hardy, good keepers, and generally prolific, especially when care is taken with the orchard. They are frequently held by farmers until spring, and Russets sometimes until the middle of May. In packing care should be taken to leave the stems on as much as possible. They are barreled immediately if dry, the barrels are then corded up under the trees on dry ground, and if covered with a few boards would keep off the storms. Let them remain there until there is danger of freezing. Then, on some cool, dry day, remove them gently to the cellar, which should be dry and very cool. Keep the cellar as near the freezing point as you dare to; do not disturb them by rolling or opening them until they are wanted for market. In this way, I have kept Baldwins until March without any loss, and

eighty barrels of Russetts with a loss of only two barrels. I would state that old orchards should be highly manured, unless the soil is naturally very rich, and cultivated every third year at least, the plowing being rather shallow. Mulch the trees in the fall with a load of barn yard manure to every four trees; summer fallow next year, spread the manure from the trees, and you can grub around the trees very easily, as the turf will be rotten. Throw some ashes and a little salt around each tree, wash the bark with lye, and your orchard will bear fruit unless something serious is the matter. Young, healthy trees are not apt to bear as well by being manured very highly, but will grow wood very fast. I have frequently noticed that young trees that have been stunted or mutilated are apt to bear. I think one reason why many young orchards do not bear sooner is because our nurserymen are not careful enough in selecting cions from bearing trees. Slim, smooth cions from trees that do not bear are not fit to be used. Cions cut from the whips or suckers that grow out from the body or large limbs will never bear.

Mr. F. D. Curtis.—I would like to ask the author of "The Small Fruit Culturist," if grafts from suckers will succeed?

Mr. A. S. Fuller.—Yes, but nurserymen do not use them. It does not make so much difference; more depends on the after culture.

Mr. Wm. S. Carpenter.—I am willing to take even stronger ground than the last speaker. I know that grafts from suckers even will grow as well as any others.

Mr. P. T. Quinn.—I don't know as I could give any good reason for it, but it has been my practice in the pear orchard to prefer cions from young healthy trees over those from older stock.

Prof. G. H. Cook.—A curious fact came under my observation, which has bearing upon this subject. Forty years ago I hoed corn in an orchard, the trees of which were grown from suckers which had been planted perhaps a generation or two before, and they are still thrifty and productive, and I have the privilege of picking apples from them every autumn that I happen to visit in that vicinity. This proves that suckers will make bearing trees.

Mr. A. S. Fuller.—For at least a hundred years all nurserymen in this country used nothing but suckers for pear stocks, and if it had been such a bad practice we would have fewer good orchards.

Moles and Mole Traps.

Rev. Joseph Wilson, Little Falls, N. J., showed an ingenious device for trapping these mischievous little animals, and read a paper on

their habits. The mole lives, moves, and finds its food beneath the surface of the ground, and like all other of God's creations, is admirably adapted to its mode of existence. On one point relating to the structure of the mole, naturalists express some doubt, and that is whether the mole is endowed with the faculty of vision. Goldsmith, in his "Animated Nature," asserts that the mole has eyes, though of a microscopic smallness. In this, as in some other instanees, Goldsmith drew largely on his imagination, as he did in the assertion "that the mole can dig its way so rapidly through the ground that a man with a spade cannot overtake it." This is not only untrue but ridiculous, if it be meant that the mole can go at that rate through new ground; for the speaker had watched them repeatedly in his garden and never saw one make its way at a faster rate than about a foot a minute. Reasoning from its mode of life, it is to be said that the mole has no eyes, and, besides, examination of the head, after carefully removing the hair, showed no signs of eyes; but though without eyesight, it is compensated for the defect by possessing an equivalent sense not bestowed on seeing animals. It knows the direction of a fence, or house, or barn, or tree, very accurately, and will make its way to them with great precision when it is about retiring to winter quarters. What this compensatory sense is, it would be vain to conjecture. It prefers the garden or plowed ground, for there it can work or travel with the greater ease, and there it finds its food in the greatest abundance. In the garden its course is erratic, but in the corn field it goes, with unerring precision, from hill to hill along the corn row, particularly if the corn has been manured in the hill with stable manure. It operates almost uniformly at certain hours of the day, viz., about six o'clock in the morning, at near midday, and at six o'clock in the afternoon. It keeps the same home and pursues the same track for years in succession, and it may be for life. During winter, it remains in its burrow inactive; whether in a torpid state or not, remains to be ascertained. It is unsociable in disposition, and its intercourse with its kind does not seem to extend beyond the circle of its own household. Each mole, or pair of them, appear to keep very strictly to their own feeding-ground, and will not tolerate any intrusion thereon by another. It knows the location of objects which it has never seen; the direction of a fence without touching it, and when passing a right angle in the line of the fence, will do so by describing an exact semi-circle instead of making a square turn or right angle.

What does it eat? This is the important part of the matter. I am perfectly satisfied that the common earth worm is the principal, if not only, food of the mole, and herein lies the great mischief that the mole perpetrates by destroying that worm. The blind or angling worm is a subsoil worker, whose agency in enriching the soil has not been suspected or understood. I think it more than probable that the rich soil on the surface of the earth is mostly the work of the blind worm. As you are doubtless aware, it comes up from the subsoil every night, during the proper season, for the purpose of propagating its species. On each occasion it emits a quantity of matter, variable according to the size of the worm. It is to be found in all directions around your dwellings, and in special abundance at the root of the white plantain, a plant of vigorous growth, which I attribute to the matter ejected by the worm. When the mole does not find earthworms, he may eat roots and tubers. I think he prefers worms, but may get in the way of eating many vegetable substances. In conclusion, the speaker urged it as the right and duty of every one to seek the entire extirpation of the mole; and that, therefore, "each farmer and gardener who is annoyed by the depredations of the mole, should possess himself of one or more of Wilson's patent talpacides, or mole killers." His trap consists of a weight or dead-fall, with sharp wires on it. It is so arranged that by treading on the path of the mole and setting the feet of the trap over it, he will lift the feet in working his way, and this sets free the dead-fall and he is speared by the sharp points.

The Chairman.—As our friend Fuller has made sharp complaint of the rascality of his moles, we will refer this trap to him for trial and future report.

Mr. F. D. Curtis moved a vote of thanks to the Rev. Mr. Wilson for his interesting paper, which was adopted.

Blooded Horses for America.

Miss Middy Morgan read the following excellent paper: "The subject before us is one of such vital importance to the agricultural interests of this great country, that I believe a few remarks on it are certain to be heard with attention. I take for my starting point the admitted fact that the horses of the United States of America require improvement, and from thence I pass on immediately to express how I think this desired improvement can most easily be effected. The importation of good blood into the country is undoubt-

edly the right way, but as there are many breeds of horses to select from it becomes our duty to make a wise choice. That the Arab horse is the parent of the equine race, I see little if any reason to doubt. Climate and feed are quite sufficient to account for the varied individualities we see around us here and elsewhere. The lordly thorough-bred, the shaggy Galloway, the active hunter, the stately carriage horse, the ponderous dray or wagon horse, and the diminutive Shetland, are one and all descended from the faultless Arab. Let us for a moment consider the desert horse. There are now in Arabia five distinct families of the clean-bred Arab horse, directly bred from the five favorite mares of the Prophet. These horses are guarded with jealous care; their pedigrees are kept without an error, and to purchase a mare of any one of those families is simply impossible. No sum will tempt the Bedouin to part with his mare. Intrigue or powerful interest will, at a high figure, occasionally obtain a stallion of some one of those fine breeds; generally, when they leave the Arabian peninsula, they come as presents from the Sultan of Turkey or from the Viceroy of Egypt to some European sovereign; occasionally, but rarely, an Indian rajah presents one to the Viceroy of India or to some British officer. Under these circumstances the animal is certain to be pure bred, but under no other. During my wanderings I never saw but three pure bred Arabs. One of those is a chestnut horse called Bard, the property of the Queen of England, presented to Her Majesty by the Sultan of Turkey. The second is a black horse, the property of the hereditary Prince of Piedmont, presented to His Royal Highness by the Viceroy of Egypt; and the third is the property of Col. Calvert, a British cavalry officer, and was taken as loot in the last Indian campaign. He is also a chestnut horse. The bony structure of the Arab is small; he rarely exceeds fourteen hands two inches; his head is beautiful; the forehead is Grecian in profile, the eye is large and full of fire, the nostril is expanded, and the lips are thin, and the mouth small; the ears are fine, pointed and erect, and always in motion; the gullet is remarkably deep cut, and the head consequently well set on; the chest is arched; the shoulder is an oblique line, and invariably the withers are rounded; the spine is straight and the tail is placed high and carried like a plume; the barrel is large and the ribs deep.

The chest, also, is wider in proportion than is generally seen in other clean bred horses. The limbs are delicate to a degree, and appear almost too fine, until we recollect that the cannon bone

of an Arab is proportionately heavier than that of any other race of horse; its texture is almost that of ivory, so dense is it. The Arab is of varied colors; flea-bitten gray the most common; next, chestnut; then black, and sometimes dapple brown, and rarely, indeed, a deep bay. The temper of the Arab is generous and fiery; reliable under the gentle rule of his nomadic owner, but he becomes, in unworthy hands, a very fiend in ferocity. His powers of endurance are almost incredible. He will gallop on, hour after hour, fetlock deep in the burning sands of the Sahara, without other food than a few dates, a swallow or two of camel's milk, and a handful of parched corn. But then, as soon as he reaches his master's tent, no care is too much for him. He is a pet of the family; he sleeps under the warmest blankets; he drinks of the most choice, and eats of the best that loving hands can give him; he is what the horse should ever be, the friend and companion of man. Now, let us consider his descendants. As all English authorities regard the English thorough-breds as the direct descendents of the Godolphin and Derby Arabians, bred from with English mares, I will particularize a few of the changes that food and climate have effected. The English thorough-bred is larger, swifter, less lovely, but more beautiful than its progenitor. He stands from 15.1 to sixteen hands in height; he is capable of immense things; at two years old he wins a Derby, and does it in less than no time; if he carries off the blue ribbon, he goes in for the Ascot with increased weight and distance, where, if he wins, he goes in for handicaps; weighted again and again on every fresh victory, until, having proved his worth, he retires from the turf to transmit his name to future ages. Blair Athol is now the most fashionable of English sires. He stands fifteen hands scarcely three inches; he is a golden chestnut, and is as fiery as horses of that color generally are. He was a most successful race horse, and, as I have no doubt you all recollect, he is the fourth son of Blink Bonny, by Stockwell. His wonderful mother won the Derby and Oaks, and did so, though, at the moment her health was so feeble that she had three veterinary surgeons in hourly attendance upon her, and gold fish were made to swim in the water she drank of, lest the crystal element should contain anything noxious to the delicate aristocrat. Another glorious descendant of the same noble line was Faugh-a-Ballagh, and never did the battle-cry of the Connaught Rangers ring to a more hearty cheer than when Ireland's dashing race-horse carried his colors to the front, and the almost fearless Faugh-a-Ballagh was declared the

winner of the Leger. Leamington, one of his best sons, is now in America; he was imported by Mr. Cameron, of Staten Island, who sold him a short time since to Mr. Welch, of Philadelphia. Leamington's late stable companions, Hampton Court, by Young Melbourne, and Warminster, by Newminster, are just two as good stallions as it would be possible to purchase. They were imported by Mr. Cameron, who we may cordially congratulate on still owning them.

Hampton Court is a bay horse, with a splendid trotting action; and now, that Warminster's mighty sire is no more, he must of necessity stand still higher in the estimation of all sensible breeders of racing stock. There is still another race of horses peculiar to Ireland. I speak of the three-fourth bred Irish steeple-chase horse, an animal unrivaled for pluck and determination, active as a tiger, bold as a lion, reliable as trusty steal, yet difficult to manage. In unskilled hands he is worse than useless; his hearty spirit brooks no curb, and his rare intelligence enables him to discover in a moment whether he or his rider be the better man of the two. For heavy draught the Clydesdale is preëminently suited; his intelligence and docility are unsurpassed. His motive power is immense, and, when pure bred, his action is always splendid. Were I commissioned to-morrow to purchase horses to improve the blood in this country, I should not be careful to select Derby winners; on the contrary, I should secure young horses of undoubted purity of descent, of faultless shapes, of reliable temper, and with superb action, I would import thoroughbred English stallions, half bred and three-quarter bred Irish mares, Clydesdale stallions and mares. Both are necessary; there is, at the moment, such a pressing want of handsome, showy, heavy team horses in this country; and last, though not least, I would at any cost secure some clean bred Arabs, although to effect this I had to penetrate, revolver in hand, even into the heart of Sahara. From these sons of the desert I should expect great things, mating them, as I would, with the most choice mares of this country. Derby winners sell at high prices, from £5,000 to £20,000; first class English stallions, from £1,000 to £3,000. Irish mares of the approved classes vary from seventy-five pounds to £300. Clydesdales can be purchased from £100 to £500. I entirely disapprove of French blood. At best it is but mongrel, and must want the staying power of the clean bred animal. I would warn my American friends of so-called Arabs imported direct from Africa. These horses are inva-

riably Barbs or Syrians, or Gulf Arabs, always more or less impure in their strain of blood, and rarely, if ever, worth anything except as park hacks for timid ladies, or for young children to ride.

Mr. H. L. Reade.—I move, Mr. President, that Miss Morgan have our most hearty thanks for her admirable address.

Mr. John Disturnell.—I second the motion most cheerfully, and I must say that I never, in all my extended experience, had the pleasure of listening to a speech more valuable or becoming.

Dr. J. V. C. Smith.—My gratification is such that I cannot withhold the expression of it. I can bear testimony to the truthfulness of the tribute to Arabian horses, having rode one for twenty-two days in my eastern travel. It is truly an epoch to have a lady of science stand before us and speak with such perfect familiarity and judgment on such a subject, and I hope the ice will stay broken. As the destiny of men is shaped by women, so may the destiny of the horse be shaped in the good time that is always coming.

The motion was unanimously adopted.

Pear Cions.

Mr. P. T. Quinn.—Whip grafting is practiced extensively by nurserymen who grow pear trees in a large way. The leading varieties of pear cions for this purpose are bought by nurserymen at from three dollars to four dollars per 1,000. These cions should be cut early in the winter, tied in bundles, labeled and placed in a cool, damp position in the cellar until wanted. Even for spring grafting the cions will be found in better order for "working" if cut before mid-winter than when left on the trees until spring. When the cions are wanted for spring grafting, then the bundles should be packed in boxes with moss, in the way recommended for grape cuttings.

February 1, 1870.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Feeding Grain to Cows.

Mr. E. Baxter, New Salem, N. Y., would know whether it will pay, and if so, what grain to give.

Mr. P. T. Quinn.—If he wants quantity, let him give brewers' grains, shorts and buckwheat meal, with about eighteen pounds of hay in a day.

Mr. F. D. Curtis.—If butter is what he is after, he cannot substitute any feed for corn meal.

Mr. George Ayrault.—My experience in feeding for flesh is, that corn meal is rather heavy. I like to lighten it up a little with ground oats or wheat shorts. And I always give beets for dessert, nearly a peck at a feed, and two feeds a day. A creature will eat more meal and hay, and digest it better for having a peck of cut sugar beets. The secret of fattening is to get a bullock to eat just as much as he can without cloying his appetite, and make him gain gradually right along, summer and winter alike.

The Chairman.—Mr. Ayrault can prove that he speaks from experience by four of the heaviest beeves the world ever saw; cattle that weigh nearly two ton apiece. They are now on exhibition, and I would like to have a committee visit his animals, and learn the secret of his astonishing success.

Mr. Lyman, Mr. Reade, Mr. Crandell, Mr. Fuller and Mr. Bragdon were appointed said committee.

DEEP AND SHALLOW PLOWING.

Dr. Isaac P. Trimble showed a specimen of corn, and said: It will be remmembered that at one of our meetings last summer, during the very dry weather, Horace Greeley stated that "the mischievous and wicked teachings of this Club would cost the country 1,000,000 bushels of corn this season." And Mr. Fuller said that David Petit and a little knot of farmers in Salem county, N. J., were doing more harm than this Club could do good in six months. Now, here is a letter from Mr. Petit saying that a neighbor of his, Mr. Samuel P. Carpenter, had this year 100 bushels of shelled corn to the acre on meadow ground, with, plowing as shallow as he could, probably not even three inches; and that Mr. George Abbott had about as much, and here are some ears of corn from the fields of some of those farmers. When the theoretical farmers, who believe in such deep tillage, can beat these practical farmers two or three to one, it will be time enough to make such serious charges. These Salem farmers have learned by long practical experience, just how deep to plow to secure the best crops; and considering the drouth of last summer, their crops of corn were wonderful. The discussions here on the subject of the depth of tillage, have attracted more attention then we are aware of. Individual, as well as farmers' Clubs, have been experimenting, and I have much testimony to show that five inches or less have proved

better then ten inches or more. And I have reports from some who have taken Mr. Greeley's advice, and plowed a foot deep, and say, as Dr. Hexamer once said here, that the ground, for the time being at least, was ruined. I hope that this coming season that farmers, far and wide, will make a fair trial. If one believes in deep plowing, try a narrow land plowed shallow. If he believes in shallow plowing, try one strip twice the depth. Thus the practical farmer can soon settle this important question. We have but little authority to settle it here, and those who have not tried both, should be more cautious in advising.

Mr. Wm. Lawton.—We, of course, could not be expected to be so unreasonable as not to acknowledge the vast superiority of Salem over all other counties, and of New Jersey over all other States. But there is a possibility of growing weary of hearing their praises sounded here week after week, from year's end to year's end. That the farmers, whose practices have been again discoursed of, may get great corps on their soil by shallow culture is not questioned, but to say that farmers everywhere else should imitate them is to inculcate an idle and wicked waste of words and of work.

Mr. Horace Greeley.—I traveled considerably over the State of New Jersey last year, and in my judgment the corn crop, large as it may have been in localities, was, as a whole, shortened not a little by the drouth. Now, I don't know any other sure way to get moisture in a dry season than by going deep. True, you may accomplish the same result by means of irrigation, or at least to some extent; and if a farmer can turn a stream of sun-warmed water over his corn field, he has less need to fear the evils of shallow plowing. But in the absence of this agency, the deplorable results of the three-inch system are sure to come, unless in cases where the soil is of such porous formation as to permit the roots to penetrate through, the substratum is not disturbed. For instance, amid the general failure of last year's corn crop in Virginia, full 50,000 acres producing not more than five bushels each, and this mostly in consequence of shallow culture, I came upon some stretches which were plowed no deeper, and yet brought fifty to seventy bushels per acre. But, mark you, these exceptional stretches were in every instance of alluvial formation; that is, so porous in their nature as to offer no obstruction to the roots in their downward tendency. These would have grown good crops even if the surface had been simply scarified and nothing more, just enough to allow the seed to germinate. The

Jersey soils, of which we have heard, are essentially like those, and, therefore, permit the roots to run without the assistance of the plow. The truth is that soil of such a nature does not need plowing; but because that happens to be true is it any kind of guide or rule for men in general? On the contrary, it is the rule applicable to nine-tenths of all the land around us that you must plow deep or expect the corn to wither when the drouth comes. I frequently go down and visit my nephew, who is trying to cultivate some of this Jersey land, and I tell him what I believe, and what his experience is proving to be true, that even the sands are better and more fruitful when plowed deep and fertilized liberally. In Atlantic county and on lands near Salem I have seen corn all burned up with the sun when the plowing was shallow. I have touched upon laws just as immutable as that of gravitation, and I trust that the day will come when what is spoken of in this Club shall cease to mislead the people.

Mr. P. T. Quinn.—I would like to ask Prof. Cook, who is authority on this subject, if he can confirm Mr. Greeley's statement to the effect that the soil of Salem is, in its geological formation, different from that in other sections?

Prof. G. H. Cook.—Mr. Greeley states the case exactly. It is exceptional land. David Petit is reliable in everything he reports, but I do not agree with his theory at all, and I think he makes a mistake, and that all those who entertain similar opinions make a mistake, when they claim that shallow culture is best everywhere because it happens to answer in certain localities. The exact statement is that deep stirring of the soil is always better, but it should not bury the manure nor the sod: and a rotting sod will hold moisture, and on a corn crop warrant at times a somewhat shallow furrow.

Mr. A. S. Fuller.—It occurs opportunely that I have here an item clipped from "The Practical Farmer," stating that in Bridgeton, New Jersey, adjoining this very county of Salem, where David Petit, author of the five-inch theory resides, lives George M. Davis, a progressive farmer. He has been located there about three years, but appears to be making rapid strides in the direction of an improved system of agriculture and heavy crops. Though only twenty-two years of age, last season he received from the county fair nine premiums, and this year eighteen, including those on wheat, corn and potatoes. He has been practicing, since he started, deep plowing, and a friend knowing his operations sent to the office of the paper from which I quote some samples of his vegetables. One was a pars-

nip twenty-five inches long, and which the editor justly recorded as a positive argument in favor of deep culture. Mr. Davis uses the double Michigan plow, and follows with the subsoil, loosening and disturbing the soil to the depth of twenty inches.

The Geology of New Jersey in its Relations to Agriculture.

This was the subject of a lecture by Prof. George H. Cook, of Rutgers College, the State Geologist and Manager of the Example Farm of New Jersey. He spoke at much length, and learnedly, making his discourse the more intelligible and interesting by means of maps and diagrams, and without which our report must suffer. He began by saying that the geology of New Jersey is interesting both for its scientific and its economic features. Nearly all the great foundations of historical geology are represented in this State, and within two hours' ride of New York city. These formations have their out-crop in belts, which cross the State from north-east to south-west; in fact, these formations, as shown in New Jersey, are only a portion of the same formations which cover nearly the whole Allegany slope of the United States. The geological structure of New Jersey will be better understood by examining a profile view of the several formations as they occur along a sectional line drawn across from the Atlantic shore near Barnegat, to the Delaware above Dingman's Ferry. Of all this series of rocks the older has always furnished the material from which the newer has been built up. Here would be a suitable place to discuss the questions as to how the strata of rock became so folded; how they have been elevated above the water in which they were deposited; if they were once the soft mud made by the wearing away of other rocks, what has caused them to become stone again? Were the forms of animals in these rocks once living creatures, and, if so, what was the condition of the earth's surface? And how many years has it taken for all these changes to come about? Our object to-day, however, is different from these, and, however interesting, they must be passed by. The rich mineral deposits of some of these formations, too, might well occupy our time. It would be interesting to speak of the iron ore, the copper, the zinc and the gold, but they must be passed. If we refer to the section and the order in which the rocks were deposited, it becomes apparent that the surface had been greatly changed since the original deposit. The softer rocks have been worn away, the soluable ones have been dissolved, and the hard and compound ones have been dis-

integrated or decomposed, and the soft material has been carried away to form new beds. Soils originate in three ways. First, by the decay or crumbling of rocks. In some parts of our State if a railroad passes through a hill the matter thrown out, though apparently hard rock, soon crumbles and makes an excellent soil. Soils are also made by drift; that is by the debris of rocks carried from one place to another considerably remote. This removal is often for remarkable distances. In the north of the State are hills beneath which is trap rock, the crushing of which would make comparatively a poor soil. But these lands are good because they are made up partly of the dust of limestone rocks that has been carried from the north and deposited upon the trap ridges. The third way in which soils originate is by the solution of rocks and the mechanical action of water in river bottoms. Some of our richest soils are thus composed. The chemical difference in the make-up of soils is very great, and analysis is of great importance, for, if correct, it will correspond to the results developed by actual tillage. For instance, in the north of the State, along the Kittatinny valley, is a soil that upon analysis surprized me by the quantity of rich constituents with which I found it loaded. It is formed from magnesian limestone, which is composed as follows:

	Per cent.	Per acre.
Lime	.96, or in one foot deep	41,817 lbs.
Potash	2.90, or in one foot deep	126,324 lbs.
Phosphoric acid	.78, or in one foot deep	39,976 lbs.

A crop of wheat yielding thirty-five bushels of grain and two tons of straw per acre, takes from the soil, lime, sixteen pounds; potash, forty pounds; phosphoric acid, thirty pounds. By comparing the quantity taken in one crop with the amount which remains, one can see how hard it must be to exhaust such a soil. A thousand years of tillage would not take away all these important elements. The professor then gave the following as the average composition of seven samples of Cape May soil:

	Per cent.	Pounds per acre.
Lime	0.37	16,117
Potash	0.42	18,295
Phosphoric acid	0.11	4,791
Lime	0.97	42,253
Potash	0.74	32,234
Phosphoric acid	0.15	6,534

And this of a yellow subsoil, from near Shiloh, called yellow marl, and sold for a manure, is used as a fertilizer at Shiloh, Cumberland county, and sells for forty cents per ton:

Lime	0.28
Potash	0.46
Phosphoric acid	0.45

After giving these analyses of soils from various sections, the professor spoke of the deposits of fertilizers. Of these there are many in the regular formations and the superficial deposits of the State. There would be time to mention only the most important; and, first, of green sand marl. This remarkable fertilizer occurs in regular and extensive beds. Three of these are well characterized and defined. They are each about twenty feet thick, and extend entirely across the State, from Raritan bay to the head of Delaware bay, a distance of ninety miles. They slope off toward the southeast, with a descent of thirty feet to the mile, so that any one of them has a breadth of ten miles within 300 feet of the surface. The amount of the material is practically inexhaustible. It has been the means of enriching a large district of country. Land that was entirely worn out and abandoned has been restored to more than its original fertility by the use of marl alone. Its excellence is attested by the experience of thousands who have enjoyed its benefits. I am confirmed in my opinion of its value by the testimony of successful farmers, who have used it for twenty years or more, and who assure me they can better afford to incur an expense of from five dollars to eight dollars per ton than to farm without it, or to use any other purchased fertilizers, and also confirmed by my own observation in all parts of New Jersey where marl has been used. It gives lasting fertility to the soil. While all other fertilizers are exhausted, and the soils become poor, I have to see the first field that has ever been well marled that is now poor. One instance was found where poor and sandy land was marled more than thirty years ago, and has ever since been tilled without manure, and not well managed, which is still in good condition. Occasionally marled fields are seen that do not grow crops as large as they once did, but all their fertility is immediately restored by a dressing of lime; an effect which could not have been produced by the lime on unmarled land. I am averse to having the valuation of the various green sand marls, which are used in the State, based on the phosphoric acid and potash only, as

has been done in some analyses; for I do not think they are the only useful substances in it. Some have fine carbonic of lime of too much value to be neglected. And the sulphate of lime (gypsum) in many of them is enough to be very beneficial to crops. The question of the value of a manure admits of exact solution, for phosphoric acid, potassa and ammonia have a regular market value. Using the basis of Prof. Johnson, and also of Volcker, and Way of England, I estimate the value to the farmer of the various marls, extensively sold in New Jersey, as follows:

	Per ton.
Marlborough	$3 51
Squankum	7 94
Squankum and Freehold (green sand)	8 60
Cream Ridge	4 24
Pemberton	4 36
White Horse	6 05
West Jersey	7 36
Woodstown	6 45

OTHER FERTILIZERS.

There are very extensive beds of limestone in all the northern parts of the State. These are of the pure and magnesian varieties, and they furnish an abundant supply of lime for agricultural purposes in all parts of the State. Marsh mud is a substance which may be classed either as a soil or a fertilizer. It has elements in it which make it valuable for a dressing upon upland, and it is itself, when properly drained, one of the richest of soils. Here is the analysis of one taken from the marsh on the seaside of Cape May county, near the Court House:

Soluble silica	15.69
Sand	48.34
Oxid of iron	3.92
Alumina	9.41
Lime	2.17
Magnesia	1.66
Potash	2.38
Sulphuric acid	1.70
Phosphoric acid	0.33
Carbonic acid	8.83
Common salt	2.00
Organic matter	6.27
Water	5.36
Total	100.06
Ammonia	0.32

It is plain that this contains everything that is needed to make a fertile soil. And where tried as it is in the banked marshes on the Delaware, it produces the largest crops, and at the least cost, of any land in the State. This subject is inexhaustible, but our time is not, and I must close. In prosecuting the work of this survey, it has seemed to me that its useful ends should be first developed. It is in this way that it commands the cordial support of the people, and insures their interest in it. Its results in a scientific view are in the highest degree important, and I hope to see them well developed.

In the continuation of our work, we are still aiming to develop our resources. The report of last year, copies of which I will have the pleasure of sending here at an early day, will give some idea of the objects to which it has been directed.

The Chairman.—It is scarcely necessary for me to say that we have all been delighted and made wiser by the discourse with which Prof. Cook has so kindly favored us, and I regret that it cannot all be reproduced and promulgated in the reports of our proceeding, and thereby aid in advancing the cause of good husbandry. I am sure I speak the sentiment of the entire audience when I give expression to the hope that we shall have the pleasure of hearing further from Prof. Cook, and that soon.

Prof. S. D. Tillman.—I have been very much interested and instructed. The Professor has condensed for us a vast amount of scientific information into the space of an hour's discourse; but the subject ought to be developed more than is possible in a single lecture, and I trust the professor will respond to the desire which all of us have that this be done. In conclusion, Mr. Chairman, I now move a vote of thanks to Prof. Cook.

Prof. J. A. Whitney.—I would express, with the Chair and with Prof. Tillman, the appreciation felt by every person in this room in listening to Prof. Cook. There is nothing that shows the rapid progress of agriculture more than does the dissemination of scientific truths, such as have been set forth this afternoon. Farming is continually asking for greater helps from other arts and sciences. Time was when the farmer was content to break the ground with a wooden plow, to harrow in the seed with a brush or a rough drag, to cut the grain with a sickle, and thrash it with a flail. Now, by the employment of machinery for all these purposes, we find mechanical engineering the servant of agriculture. Only a generation since the husbandman neither knew nor cared to know the composition of his soil, or

the requirements of the plants that grew upon it; but in this coveries in chemistry have become the basis of successful tillage. farmers are no longer satisfied with this. They seek to go further, and learn the origin of the lands they till, of the commercial fertilizers they use, the nature of the great changes in the earth's surface that has formed the fields from whence their harvests come. They would look back, guided by the light or scientific research, to the rocks as they cooled when the world was young, and watch their gradual disintegration and decay, the slow and softening action of the elements upon them, their transport to their present resting place by seas that subsided in remote ages, and their gradual disintegration or solution into tillable and productive soils. Farmers are no longer satisfied to simply know that marl is good for potatoes, but wish as well to learn of its origin in the organic life of a period long past. It follows from this that lectures like that of Prof. Cook are becoming an important part of our agricultural literature; they are, as well, a forecast of the improved farming of the good time coming.

Adjourned.

February 8, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

CORN FOR HOGS.

Mr. H. Cope, Short Creek, Ohio, wrote to inquire the comparative value of old dry corn and corn fresh husked as food for hogs that are being fattened.

Mr. H. L. Reade said he had kept hogs for twelve months on old corn, except during occasional times of scarcity, when he used new. Without any positive information, he would be disposed to estimate the difference as equal to ten per cent at least.

Mr. Wm. Lawton thought that about the difference in the quantity of water contained in the two kinds.

DAIRY FARMING IN ORANGE COUNTY, N. Y.

Mr. Charles Singleton, Middletown, N. Y.—Dairy farming is made a specialty, the farmers being stocked to their fullest capacity with milch cows, by which system he says the land grows richer and richer every year, and is thereby capable of sustaining a still larger stock. Instead of being manufactured at the farm-house, as formerly,

the golden article is now taken to the cheese and butter factories. In the vicinity of railroads, sending milk to the New York market is the business. The railroad facilities are good. Two great railways, the Erie and the Midland, with their branches, traverse it in nearly every part. By the way, the earnings of a single milk train on the Erie railroad, by running seventy-six miles one trip per day to New York, is $750,000 per annum. Farms generally average about 100 acres, and cost from $80 to $200 per acre, according to the proximity of the railroad station. There is an abundance of stone for fencing, and it is observed that the more stony the land the more productive the soil is found to be when once cleared. The Orange county farmer, by practicing industry and economy, has grown rich and independent; that is if fine houses, fine carriages, and seven-thirties are any index. However, it must not be supposed that Orange county is the real Utopia, as many are found who evince a willingness to emigrate beyond its borders.

The Rotation of Crops.

Mr. Albert Long, Dartford, Wis., excepted to the practice of a former correspondent, who "having sown a piece of grass, does not plow the land again in less than eight years." Mr. Long prefers this system of rotation, namely, meadow, pasture, corn, barley, wheat. He believes if this were adopted by the prairie farmers it would be greatly to their benefit, and would actually enrich their land. He has land (lately purchased) which has been plowed for twenty-two years in succession without manure or grass seed, producing, as near as he can get at it, eighteen crops of wheat, two of corn, and two of oats. Last year it yielded at least two tons of clover and timothy hay per acre for the first crop. Now, he contended, if this land is kept in grass two years in five hereafter, and all the hay and straw made into manure and faithfully returned to it, will it not grow richer? There can be no question but it will. Hence I would advise our western farmers to try this system of rotation first, then if they think they can make it profitable, at the rate we are compelled to sell beef cattle, to mow their lands sixteen years in succession, they may do so.

Western North Carolina.

Prof. Henry Colton, formerly connected with the North Carolina geological survey, spoke at length of the western section of the State.

The Alleghanies, proper, have ceased before reaching the State, but a range runs parallel to the Blue Ridge, forming the boundary between North Carolina and Tennessee, called the Unaka or Smoky mountains. This last is cut through by all the waters rising in the former which flow west. All these, except New river, which empties into the Ohio, go to form the Tennessee river. Between these two ranges are high mountains; well situated table lands and beautiful valleys, wide and fertile, cluster along each rill and creek and river. Asheville is the geographical center of all this intermontane region. Its location is on the French Broad river, along whose banks run the old Indian trail and the early settlers' road; in fact, having been ever, until late years, the only good pass through the mountains. This whole region has an average elevation of about 3,000 feet above the level of the sea. The climate has not its superior for evenness of temperature and dryness of atmosphere; the mercury seldom goes above or even as high as eighty-two degrees in summer, and then but for a few hours, and not often lower than twenty-eight degrees in winter. Dr. H. P. Satchell has made a careful examination of this whole section, and pronounces it the healthiest part of the United States, especially for consumptives. It has long been the summer resort of wealthy planters from the far south, attracting them and others by the beauty and grandeur of its scenery, as well as its delicious, invigorating climate. The scenery on one of its rivers, the French Broad, has been the wonder and the admiration of all who have ever seen it; and Mr. Sweetser, in his guide-book of summer travel, says it is equal to that of the Rhine. He stands not alone in this opinion; Leanman goes into ecstacies over it. The geological formation of this whole region is primary. Just beyond the mountains on the west, in Tennessee, we have the secondary formation and abundance of coal. Limestone is plentiful, especially in the extreme southwest, where fine marbles of white, gray, mottled, black and flesh color, are found. Iron, copper, lead, silver, zinc, manganese and gold, are found in considerable quantities, but have as yet been but little worked. The soil is a dark gray or black loam, except in some of the river valleys, where it is a mixture of these with red and yellow clay. It is extremely rich, even to the tops of the highest mountains. The chief crop has been corn; but the farmers are beginning to awaken to the fact that the small grains are better suited to their soil, and that the fattening of beef is more profitable than raising hogs. Hence their attention has been

turned to grass raising and to dairy farming. The tree growth is oak, chestnut, sugar maple, black and white walnut, ash, hickory, hemlock, spruce pine, balsam, a species of wild cherry, the Magnolia acuminata or cucumber tree, etc. Except where there are thickets of the rhododendron, there is but little undergrowth, and one may ride on horseback up or along the mountain sides without caring for path or road. The ground is almost everywhere covered with the wild pea vine or clover, and a natural grass, resembling the blue grass of Kentucky. The yield of various crops under the farming that has existed there, is not a criterion of what can and will be done in the future. The speaker said he had seen 149 bushels of corn gathered from one acre of land on the French Broad, but the average crop by the ordinary farmer was forty to seventy bushels per acre. Wheat was but little raised there before the war, and there were in 1860 but two or three first class flour mills in all the thirteen counties west of the Blue Ridge. It had as good returns as corn, but as there was no outlet to market, it paid better to raise the corn and put into pork. In the valleys of all the streams the lands are astonishingly fertile. On the Pigeon river there are farms which have been cultivated for over fifty years and yet produced 100 bushels of corn to the acre. The same may be said of the valleys of the Tennessee, Tuckasaga Valley river, Kiowee, and Hiawasses. The three last have been in cultivation hundreds of years. Buckwheat, flax, hemp, all grow and give large returns. In fact any plant which grows in the valley of the Mohawk will flourish there. Irish potatoes give a larger yield from the native soil than in the north; the usual crop is 250 to 300 bushels per acre, and we have known 600 bushels gathered from first year's land, off which the trees had not been cut, simply girdled. This, too, was mountain side, perhaps 3,000 feet above the sea level. The mountain sides grow all the grains with good yields, but are more profitable for grass. Timothy has been known to grow over six feet high on a mountain that is 4,000 feet above the sea level. That it must become a great dairy-farming and stock-raising region is evident, and will be the conviction of all who visit it. All varieties of apples, pears, plums, cherries and grapes, grow and ripen. It is the native home of the famous catawba grape. The climate of Asheville is about the same as that of Dijon, France, where the best Burgundy wines are made. The peach seldom ripens in this State east of the Blue Ridge, yet there are valleys which, from peculiar location, are free from frost till much later than the surrounding country. Of all

this intermontane region, comprising over 7,000 square miles, there are, probably 3,000,000 acres in forest, in which the axe of man has never entered. It is the idea of many that a mountain is a barren, but in western North Carolina they are covered with soil instead of rocks; with giant oaks, chestnuts, and walnuts, instead of stunted trees; with rich green grass, instead of parched up brown sedge. However, of course, there are barrens. Land cleared and near Asheville is worth from three dollars to twenty dollars; wooded land, at greater or less distance, from fifty cents to three dollars per acre. Some large mountain tracts might be bought for less. Mr. Colton further stated that three cheese factories have already been established, the active man in the enterprise being Judge Woodfin, who, by the way, has done much for his section, having given a good deal of attention to scientific tillage.

The Tomato and its Culture.

Mr. J. Payne Low, Little Falls, N. J.—It is now seasonable to speak of the culture of this delicately acid, cooling, healthful, and much-valued fruit, whose hygienic qualities have been well tested in the human system, that most perfect of laboratories. Other fruits of the garden have been long in reaching their present perfection; whereas the tomato has been a comparatively short time under culture. My experience has satisfied me that it is most susceptible of improvement; then why grow coarse, unsightly, spongy, ill-flavored tomatoes when, by attending to a few simple but important things, the finest qualities may be had. Seed from fruit which ripens earliest will produce the earliest next season, and if properly grown, and from the best variety, will give the desirable qualities of earliness, productiveness, size, solidity, fewness of seeds, beauty of form, thinness of skin, delicacy of flavor, and richness of color. For germinating seeds in a little box all that is wanted is a few inches of rather light, rich soil; the box in the sunshine in a warm, well ventilated room, the box covered with glass to counteract the dryness of the atmosphere; and plants once growing must receive no check from want of care. A few plants well grown will be worth far more than any number of those crowded to suffocation in dealers' hot-beds. In the neighborhood of New York the seed may be germinated (in the little box) about the middle of February or beginning of March. Frequent transplanting is very desirable. Begin to do so when the plants are two or three inches high. Let them not be put in the open

ground till all danger of frost is past, unless they are protected. In transplanting let the soil be well watered, so that a ball of earth may go with each plant, thus preventing the growth of the plant from being checked. A uniform warm temperature is desirable, but the plants must not be kept so hot as to grow sickly. They need all the light they can get and as much fresh air as they can stand. Let them have a light, rather than heavy, and a rich, but not over-rich soil; and if on the southeastern exposure of a hill side, all the better. They should not stand less than four feet apart. Keep the soil friable; let no weeds grow; hoe early and often. For a late crop, sow in spring. The plants in place will grow till frost comes, and longer, if protected. Cut out suckers; shorten the vines, and nutrition will flow to fruit instead of making fibre; nor will there be loss of fruit, for most of it grows near the ground, and vines thus pruned will produce larger fruit. The advantages of pruning have indeed been questioned, but *my* tomatoes grow best when well pruned. I have tried all the popular varieties, and I am now satisfied beyond a doubt that, for family use, no other variety equals Lester's perfected tomato which, although not one of the newest kinds has for years been favorably known. It, however, others may differ with me on the subject of varieties, I trust they may coincide with me on the subject of culture.

Wheat—Where Raised and Where Consumed.

Mr. J. Disturnell read an interesting paper on the above subject, alike effecting the farmer, the mechanic, and the merchant. He showed from the census returns of 1860 that 173,104,924 bushels of wheat were raised in the United States, giving five and one-half bushels to each inhabitant. While the New England States produce only twelve quarts to each person, the middle States produced nearly four bushels, the southern States three and one-half bushels, and the western States ten bushels. California produced fifteen bushels to each person. New York, in 1860, produced only 8,681,105 bushels of wheat; or about two and one-half bushels to each inhabitant. Pennsylvania, according to the census of 1850, raised more wheat than any other state in the union, 15,367,691 bushels; in 1860, 13,042,165; or about four bushels to each person. Illinois, the greatest producer in 1860, raised 23,837,023 bushels being upwards of twenty bushels for each inhabitant. In 1870, no doubt, the greatest yield per acre will be found to be west of the Mississippi

river, in the states of Iowa, Minnesota and Nebraska; while California and Oregon will outstrip any region east of the Rocky mountains. This statement shows conclusively that the only wheat region in the United States where an excess is found over the home consumption is in the western and northwestern States, and in California and Oregon. Wheat and flour now stand first in rank and value, except cotton, in our export trade to Europe, and go far to support our shipping and commercial interests. The following statement relating to wheat and flour sent to the European markets, during the past twelve years, is of importance. The *first* striking fact is that Great Britain affords nearly our entire European market—amounting to over ninety per cent, of the total breadstuffs shipped to Europe. This large percentage, however, constitutes only about *one-fourth* of the entire supply of foreign wheat that is annually consumed in the United Kingdom. The *second* fact to be considered is the fluctuation of prices in Europe, which governs, in a great measure, the price of breadstuffs in the United States, benefiting the farmer and shipper only when there is a scarcity in foreign markets, to the injury of the home consumer, who then has to pay high prices. The *third* fact presents itself in the cost of transportation from the interior of our country and shipment to Europe. Here the carrier comes in for a rich reward, at the present time getting as much for freight as the farmer for his labor. If winter wheat be worth $1.40 a bushel in Liverpool, England, there would have to be deducted for carrying from Chicago and marine freight to Europe, with other charges for insurances, &c., about seventy cents, leaving only seventy cents for the American farmer. When these facts are all duly considered, it shows the ruinous policy of undertaking to compete with the Continent of Europe in the English markets, they only paying remunerating prices when so compelled by short crops at home. Another fact deserves the attention of the American farmer, that is the yield per acre of wheat is decreasing in all the States east of the Mississippi river; while in England and on the Continent the yield is holding its own or increasing, owing to superior management in manuring and tillage. The ruinously inconstant market abroad, and the present high charges for transportation, will, no doubt, shut out the exporting of breadstuffs to Europe. California alone will have the best chance as a competitor in the English market from this time forward, owing to the trans-shipment being direct, by water, to Europe.

Large Crop of Corn.

An interesting communication was forwarded by Mr. P. C. Wood, of Hillsboro, Ill., giving an account of the practice of a neighbor of his, Amos Coltfelter, who, last season, raised six acres of corn "which yielded, by actual weight, 115 bushels and fifty pounds of good, sound, merchantable corn to the acre." The field was in corn in 1868, and in the spring of '69 was plowed and let lie until the weeds had got a pretty fair start; then it was plowed again and the corn was planted in drills, a little more than a peck of seed to the acre being used. While the corn was growing it was plowed three times, and that was all the cultivation it received. No manure of any kind was used or ever had been used on the land.

Dorking Fowls.

Mr. O. S. Bliss, Georgia, Vt., having noticed that a committee of the Club recently reported the breed as not hardy, begged permission to disagree. He said: I have a flock of twenty pure, gray Dorkings, bred from the stock imported by M. H. Cochrane, Esq., of Montreal, the most beatiful birds of the breed I ever saw, and there has not been so cold a day this winter that they have not been out, while the Brahmas, of which I have a flock of twenty, bred from what is known among us as the Ives importation, have hardly ventured out at all. So far this winter the Brahmas have laid the most eggs, but last winter the Dorkings did the best. The Brahmas are kept in a close basement, where it has not frozen this winter, with a shed to run in, and the Dorkings in an open and exposed stable. The Brahmas consume at least ten per cent more food than the Dorkings. I kept them last summer in portable coops, that were moved every day, usually letting the hens out a little while just at night to forage, varying the arrangement by letting out all of one breed, including cocks, one evening of each week; and we never had our hens do better. By this arrangement all trouble with hens in the garden and among the grain was saved, except the little while in the evening when the children were set watching them. The Dorkings endured the confinement better than the Brahmas, and consumed much less food. Dorkings are as heavy as the Brahmas, and the flesh is as much superior as South Down mutton is to Cotswold. The eggs are a quarter larger, and equally nutritious, and the chicks much more lively and hardy. I set both kinds of eggs together, and kept the chicks together till they were taken from the hen, and find the Dorkings the most tracta-

ble and fondest of attention, and although I do not propose giving up the Brahmas, I shall insist that the Dorkings are everywhere the most desirable.

Adjourned.

February 15, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

CURE FOR WORMS AND CRIBBING IN HORSES.

Mr. C. M. Wyvell, Portville, N. Y.—One drachm each of white hellibore (powdered), sulphate of iron, and coriander seed, and one ounce of powdered flaxseed meal. This is for one dose for worms, and should be given at night with bran mash. A repetition will seldom be found necessary, unless the horse is aged. Cribbing is not a habit, and it can be cured without resort to the celebrated neck-strap. Let any one sufficiently interested take the worst old cribber he can find, examine his mouth, and ascertain whether the pressure is made with the upper or under nippers, or both; provide himself with the necessary straps to lay him down, secure him in an easy position, take a small tooth-saw and open carefully between the affected teeth well down to the gums; with a small sharp knife loosen the gums around the teeth, both inside and out; and the poor fellow, who has suffered for years, is cured of his habit.

AN ADVERTISING SYSTEM FOR FARMERS.

Mr. F. Collins, Morrisville, Pa.—Let every country storekeeper procure two good-sized blank books, with paper suitable for writing upon, and to be used by the farmers to advertise the articles they have for sale, and also those they are in want of, one of them to have the heading "For Sale," the other that of "Wants," and on the outside the title of "Farmers' Advertiser." To avoid a little expense, one book might answer the purpose by using one part of it for the "For Sales," and the other for the "Wants." Have a strong string, or tape, fastened to the books, and hang them in some convenient and conspicuous place in the store. Should any storekeeper think it an unnecessary expense, let him charge, say five cents, for every advertisement when inserted; but I think he would be amply repaid by bringing him more custom. I would make the country stores the central points, these being the places where all farmers meet, and not the hotels and drinking places, which need no more attractions.

This is not designed to take the place of the usual advertisements in the newspapers, or the notices of public sales, but it is convenient for private sales, and those which generally are too small to admit of advertising in a newspaper, such as are continually taking place between farmers, and are generally accomplished by personal intercourse.

Report on Mr. Ayrault's Great Beeves.

The committee, consisting of J. B. Lyman, C. D. Bragdon, H. L. Reade, A. B. Crandell, and A. S. Fuller, appointed to visit the great steers fattened by George Ayrault of Dutchess county, N. Y., and sold to Mr. Lalor of this city, reported as follows upon their size, appearance, and more especially upon the methods by which such remarkable results were attained: The beasts are of wonderful size, the biggest of them standing nearly six feet from the ground. They are as fat as they are big-boned, and weigh, as we are informed, from 3,300 to a little less than 4,000, nearly two tons. We expect to receive from Mr. Lalor precise returns as to their weight on hoof and the quantity of dressed meat and tallow from each animal. In blood these beeves are seven-eighths short horn; the other eighth is of a large boned native animal. They are not pedigree cattle, but have been bred for fattening qualities. The sire of their father was a Kentucky bull, and the mother was from a good herd in western New York. They were fed in the usual way till three years of age; that is, they had good summer range, and sweet hay in winter with a little grain, especially oat provender or wheat shorts, on which their growth was uninterrupted, but not very rapid. At the age of four the fattening began. They were given a peck of dry meal each day at two feeds. The meal was mostly Indian, with some rye shorts or oat provender to give it lightness, and to furnish more gluten and more bone phosphate than could be expected from the Indian meal alone. They were also fed about the same quantity of roots as they received of grain, nearly a peck at a feed twice a day. They had at all times as much early cut, sweet, upland hay as they could eat. In summer they had two ranges for pasturage, one new seeded and the other old bottom. They ranged over each lot every day, and thus had ever a variety of grasses. Moreover, they were fed with hay in summer. It was found that, no matter how good their pasture, they never lost their appetite for a lock of good, sweet old hay, not even in July. As the object in fattening an animal is to induce him to eat and to assimilate the greatest quantity of flesh-making food, variety should

be carefully studied. When he seems to have enough of the best of hay, he will eat roots with a zest; and, full as an animal may appear to be of nutritious grasses, he will eat good hay with an avidity somewhat surprising. When these steers were four years old and past they weighed from 2,000 to 2,500. The year following they gained about 500 all around, and their weight was from 2,500 to 3,200 and over. The year following, the last year of their lives, though great pains were taken, they did not gain as fast; and in the past two weeks they have gone back eighty pounds each.

He is a good feeder who can in a twelve-month get his herd to take on 400 pounds all around; but Mr. Ayrault has had beasts to take on 500 and 600 pounds. So far as profit is concerned, he has gained nothing from the last year of their lives, except in the fancy prices which animals like this command, simply on account of their magnitude. He thinks five years is the age when a fattening animal is likely to yield the most for the care and food which he has required. He is doubtful whether it pays, as a general practice, to feed cattle to such immense size. Great care and watchfulness are required to keep the appetite free, a constant and wise variety of food must be given, and it is only an accident that cattle can be found so wonderfully disposed to take on flesh. Your committee cannot but express a conviction that Mr. Ayrault deserves the thanks of farmers for having shown, to a degree never before reached in this country, the results that may be had by a wise choice of animals to fatten, and by constant care and skill in feeding. He has proved, also, the wonderful and exact adaptation of the short-horn stock for beef-making.

LARGE CATTLE.

Mr. C. S. Marvin, Oxford Depot, Orange county, N. Y., raised a steer called "Uncle Abe" that will compare with some heretofore reported. Uncle Abe first made his appearance on the 19th of October, 1864, and then weighed 134 pounds, and girth, three feet and three inches.

	Pounds.	Girth.
At three months, weighed	385	4 ft. 6 in.
Six months	670	5 ft.
One year	1,036	6 ft.
One year and six months	1,354	6 ft. 5 in.
Two years	1,616	6 ft. 10 in.
Two years and six months	1,830	7 ft. 4 in.
Three years	2,070	7 ft. 7 in.
Three years and six months	2,270	8 ft.
Four years	2,360	8 ft. 2½ in.
Four years and four months	2,530	8 ft. 4 in.

Was butchered fifteen days later; his beef weighed 1,550 pounds, had 264 pounds rough fat, and was, as you may suppose, excellent eating.

From ten days old he ate a quart of meal and oats; increased gradually to two quarts, and the cow had all the meal she would eat until spring. He ate three quarts per day the first summer, and had first-rate grass. The second winter he ate four quarts per day of meal and oats and two quarts of roots. The second summer he had four quarts per day of meal, and gradually increased his feed until the last winter he ate eight quarts, and the best of hay always during the winter, together with roots.

Fat Animals as Food.

Dr. J. V. C. Smith.—I would not be satisfied, Mr. Chairman, to allow this statement about very large and fat cattle to go out as an indorsement of the popular prejudice in favor of such animals as the most suitable for food. On the contrary, I am satisfied that when an animal has become very fat he is more or less diseased, and for that reason is not suitable for our tables. In early and pastoral times, animals were never stall-fed, but taken from pastures where they had free range and high health. In eastern travel I have noticed that the Bedouin Arabs, even those that are old, still retain their vigor and firm health. The accumulation of fat is much increased by certain conditions that induced a diseased state of the organs, The famous *pate de foi gras*, or pie of fat geese livers, is produced by nailing the poor animals to a floor in a very hot room. Unable to take exercise, and confined in a sweltering air, the poor creatures fall sick, their livers enlarge to a monstrous size and often have abscesses or sores upon them. When their sufferings are about sufficient to produce death, their heads are taken off, and these overgrown livers used to make a pie, which is eaten by some gouty epicure, for which he pays the price of many pounds of healthy natural flesh. Heat and darkness promote the accumulation of fat, but they are inconsistent with the highest efficiency and vigor of an animal. The best of all meats is considered to be the flesh of birds and wild animals, and, strange to say, the next best meat is considered to be the flesh of animals confined and over-fattened. We cannot be wiser than Moses was, and he expressly forbade the use of pork. As a physician, I have noticed that the Jews, who religiously abstain from swine's flesh, are remarkably free from eruptions, carbuncles, boils and salt rheum.

As a people they are more particular than any people in the quality of the flesh they eat. Their butchers are carefully educated to distinguish bad meats of all sorts, by the look or the feel, and in this city no better flesh can be obtained than such as is killed and sold by Jewish dealers. The word scrofula is derived from a term which means sow, and medical men will, almost to a man, testify that it expresses a true connection in morbid pathology. I am surprised that fat meat always sells so much higher than lean, unless it can be shown that lean flesh is defective in flavor and tenderness. We pay, for instance, thirty cents a pound for a fat cut, and reject twenty per cent of it in the tallow which is unfit to be eaten. If our climate were excessively cold there would be better reason, as we know the Esquimaux drink train oil as we do water, and the whales killed in the Greenland seas are the fattest. In high latitudes fat is laid on by beast and fish as well as consumed by man in order to protect the vitals from the effects of extreme cold. But those who consume fat meat in this latitude do it for no such reason. In conclusion, Mr. Chairman, I find my ideas so well expressed in three verses of old English doggerel that I quote them, thinking that by such quaint phrase they may stick in the memory better than from such consideration as I have presented:

Who eats the leanest
Is the keenest
  In wit and repartee,
Since sense and fat,
Like dog and cat,
  Never will agree.

Then shun that food,
It is not good
  For stomach or for brain.
'Tis full of ills,
Requiring pills
  To make us well again.

Thus, dainty bits
Destroy the wits,
  As William Shakespeare said;
So if you're so prone,
Let fat alone,
  Or you'll be sooner dead.

Mr. J. B. Lyman.—While agreeing with all that Dr. Smith has said about the unwholesomeness of pork I must think the general preference for a fat bullock has good reasons. We have in this city

frequent opportunities of getting beef as lean as Dr. Smith could wish. They come from Texas, and sell for about ten cents a pound, while good plump Kentucky and Ohio animals sell for seventeen and seventeen and one-half. People will think that the seventeen cent beeves have a finer flavor, and somehow this flavor is connected with their condition as to fatness. However, the exact degree of fatness to which an animal had best be brought in order that the meat may be nearest perfect, has not yet been determined, and it is a subject which would repay more careful investigation.

SILK-WORMS THAT FEED ON THE LEAVES OF THE OAK AND AILANTHUS.

Mr. J. Q. A. Warren, correspondent of the Entomological Society of Belgium and of the Silk Association of London, has just returned from Europe, bringing with him the eggs and cocoons of the silk-worms that feed on oak and ailanthus leaves. He showed many specimens of the new silk, and of the animals which make it, and said: "To go into the details of silk culture would occupy hours of time. As a subject it is one of too great importance to be lightly dwelt upon. My object is to ask your attention simply to a few remarks upon the new species of silk-worms now in successful cultivation in Europe, viz., Those who feed upon the oak and ailanthus. The materials I have gathered upon this subject while in Europe are quite voluminous. From visits to many of the principal menageries in France and England, where not only this species are raised but also the *bombyx mori*, I have endeavored to collect the experience of the most prominent breeders who have made the subject of silk culture a study for years, as well as to make researches among the foreign works on the subject, which, in the most condensed form, I now offer you. French sericulturists have endeavored to obtain and introduce all the best silk producing insects that could be found, discarding such as were of no practical value, and reserving only two or three species which seemed promising. Of these I will allude to the two most prominent, *bombyx, yama-mai*, that eats oak leaf, and *bombyx cynthia*, that feeds on the ailanthus. The oak feeder was first introduced into Europe about the year 1861, after great difficulty. The eggs were procured through the influence of the French Consul at Japan, M. de Bellecourt. Many efforts have been made, unsuccessfully, by other parties to procure eggs of this species, on account of the reported beauty of the fabrics made from the cocoons; but the species were so highly esteemed in Japan, the law forbade

their exportation under punishment of death. The Japanese had for many years been cultivating the oak silk-worm, together with the common worm, the produce of which was used for making the rich vestments for the royal family. The eggs above alluded to were sent to the imperial government of France, and placed in the hands of the Society of Acclimatization, at the Jardin des Plantes of Paris. From the want of proper food many were lost or perished, as their habits had not become sufficiently known, but a portion were saved through the efforts of the president of the society, who procured young oak leaves from the south of France to feed the worms in early spring, until the foliage had become sufficiently advanced on the oaks in Paris. The above reason is the true one why this valuable species of worm and silk was for so many years unknown to the naturalists and merchants of Europe. At the present time there is no difficulty in procuring supplies of the eggs from Japan, though great care is necessary to bring them over in a perfect state. M. Personnat, of Laval, and M. Guerind Meneville, of Paris, both learned entomologists and sericulturists, and who stand at the head of naturalists in France, have been most indefatigable in introducing and rearing many new and valuable species of silk-worms; they have devoted much time and attention to the oak-feeder, and speak favorably of this species as one of the most valuable among the races in the domestic menagerie of France, though, in the experience of both gentlemen, much trouble and expense has been incurred in their propagation, having been quite unsuccessful for years.

After repeated attempts and experiments they have succeeded in bringing to perfection this delicate and beautiful insect, and raising thousands of cocoons. Their opinions are most favorable as to the ultimate success of the oak-eater, and predict they will yet be grown on a large and remunerative scale. Great care is necessary in feeding, and many experiments had been made to ascertain the best methods. M. Personnat raised thousands of worms, partly in the open air on oak shrubs, and partly in an open room with cut boughs, each with success. He also recommends the long boughs of oak in pots, or oak trees covered with net-work. His accounts, covering the experience of years, is quite lengthy and extremely interesting, which has been translated from the French, showing the success which has attended his cultivation of this valuable species in Europe, while others have met with much disappointment. He has also drawn out a scale of profits to

be obtained by cultivating this valuable worm on an extended scale, which is very valuable for reference, being an approximate estimate of the result of his cultivation from years of experiment. Trials made in England were for years unsuccessful until the past season, when, after repeated attempts and much expense, Dr. Wallace, of Colchester, succeeded in raising and rearing the oak-eater. He has published several works, giving his experience, together with full description of this beautiful insect. He paid particular attention to the temperature. The worm avoids sunshine, but likes the warmth diffused through the leafy shade. They will bear a moderate amount of cold, for brief periods, but great care must be taken regarding ventilation. The experience of the gentlemen previously named coincides that he thrives better out of doors on the tree than when confined in rooms. Dr. Wallace has found that in England the worms thrived well in a freely ventilated room with a temperature of about seventy degrees equable and rather moist, Cleanliness is most essential. The best varieties of oak, as used by the Japanese, for rearing this worm, are the *quercus dentata*, *quercus serrata*, and *quercus sirokasi*, being the trees which vegetate earliest and having the most tender leaves, are the best for feeding the worms, the silk made from them being strong and valuable. The worms are very particular as to the quality of the oak, and great care is requisite in feeding, as they require twigs with the leaves, and not picked leaves. The young worms must be fed on no other food but the oak; must not have lettuce; but feed only with oak sprays kept in fresh water. Plenty of pure air is most desirable. *Quercus pedunculata* is an early variety, and much preferred for open-air culture. The Japanese gather branches, place them in bottles, and place the young worms on the leaves. The oak-eaters require plenty of food, constant attention, and are quick growers, constantly eating night and day. *Quercus cerrus*, or Turkey oak, is much relished by them, although other varieties will answer. This worm is a native of Oshin, Japan, where it is cold in winter and warm in summer. The eggs taken from this district thrive well in England. Heat will not kill them, but they are readily devoured by insects and birds, unless properly covered on the trees, by netting. The Japanese seed is in great demand in the French markets, also in England.

Ailanthus culture has become a success in Europe, and, at the same time, let it be known that it requires much less labor than

the mulberry silk culture. The ailanthus will flourish on almost any soil, even where very sterile. In England and Holland, and other moist climates, experience has shown that the ailanthus tree grows luxuriantly, and that the insect attains a large size, and makes a fine cocoon.

Regarding the tree, it is well known that it is one of the easiest to propagate and grow, and it will thrive on any soil, no matter how dry or sterile. Regarding the silk, everything is in its favor—and its qualities have been appreciated by manufacturers at Roubaix and Lyons, and others who know its worth. A noted chemist and weaver in France has found that the gloss of the ailanthus silk far surpasses any of the other known varieties of *bourre de soi.* Weavers have found the cocoons easy to card and spin, and the thread is strong and an excellent stuff for certain manufacturers. The silk is easily cleaned and will take a good dye better than the *yama-mai*, and from experiments made will permit a stronger and finer gloss than that of the oak feeder. To prove the immense utility of the cultivation of the cynthia in France, Father Incarville said: "The silk produced by the ailanthus lasts double the time of that made by the mulberry worm, and does not spot so easily, and washes like linen. It is said that the strength of the silk is very surprising, and the durability of the Indian foulards, which are composed entirely of ailanthus silk, is attributed to this fact. The cocoons of the ailanthus are elongated, of a pale, gray color, very close tissue, one and a half to one and three-quarter inches long, and about three-quarters broad, varying in size and weight. The worm begins its cocoon by securing itself firmly to the main stem of the leaf with its silk, so that in winter, when leaves fall, it may be secure, showing a remarkable instinct. The demand for this silk is on the increase in Europe; for it is well known to be very serviceable and durable, and the cocoons are reeled off in one continuous thread. The ailanthus tree is easy of cultivation, and can be raised to any extent in America, and the advent of this new insect, the *bombyx cynthia* will make an important era in sericulture in America. It is easily multiplied and acclimated, and its cultivation must become successful. While in England, last August, I visited the farm of Dr. Wallace and saw some 18,000 worms feeding in the open air on the *ailanthus glandulosa.* The same month I had the pleasure of paying a visit to the beautiful country seat of Lady Dorothy Nevill, Dangstein, Petersfield, about fifty miles from London. Her ladyship had

planted a large number of *ailanthus* trees in a portion of her beautiful garden, and covered them with a strong inclosure of net-work to keep off the birds. There were hundreds of young trees growing, and thousands of worms feeding in the highest state of perfection, a beautiful sight, indeed, on entering the inclosure to see those magnificent silk-worms, from one to three inches long, of an intense emerald green color, with the tubercles tipped with a gorgeous marine blue. They seemed to care nought for wind or rain; their feet having great adhesive power, they cling to the leaves with a peculiar strength; their bodies, being covered with a fine down, seem to turn the rain like the leaf of the cabbage. Some were eating; some dormant; others commencing to spin like weavers, and many had made their cocoons and were stowed away in the leaves. Lady Nevill says they are cultivated at little expense and the *ailanthus glandulosa* is easy to raise. A ready market is found for all that can be cultivated; while the English cocoons are said to be finer than the French. The females lay from 300 to 350 eggs; and the average is about 450 eggs to a gramme, a gramme being equal to fifteen and one-half grains. A tree will produce about 100 cocoons when in good bearing and planted in good soil. To America what a boon is offered in the introduction of these new species, and the utilization of oak leaves; a material which has never been of the least value, has now suddenly become valuable, nay, precious. If such a statement had been offered one decade ago, it would have been looked upon with derision, but now, by the medium of an insect, our trees and hedges, and the once neglected ailanthus, are, by a modern change, converted into a precious silken fabric. Whatever may be done, or however extensive the cultivation of this new species, they can in no way injure the success of the *bombyx mori*. This beautiful study opens up a field, not only for entomologists, but for all interested in natural history or the industrial pursuits of the day; nor need it stop here. Its progress mus be onward, and should be also encouraged by the fair sex, who will, indeed, find it not only a healthful and life-giving pursuit, but a beautiful and interesting study; for it will open up to their nimble fingers a most extensive and remunerative source of labor; more than that, it will prove a relief to many districts purely agricultural, where the want of manufactures is the chief bar to prosperity and progress.

As the materials are all around us, provided by nature, ailanthi-

culture should take a rank among our prominent industries; for silk is silk, and practical men, who have a keen eye to business, should examine into this new industry, and make it remunerative to grower and manufacturer. It would also open up a great field of employment for the women and children in various portions of our country, and be the means of bringing into general use a useful, handsome and durable material. Let us by our influence and united efforts do all we can, and strain every nerve to enrich our country with this new and valuable industry, and induce others to make trials with these valuable races, which must become of great importance, and lead to ultimate success, "that our American ladies can, by the introduction of this beautiful material," be enabled to wear robes of satin at the cost of those of wool. Then we may indeed show to the old world the true genius and dignity of American labor, and offer garments from American looms fit to clothe a king, or to be worn by a prince and princess royal, for they would be good enough for us. and we, in our own way and after our own fashion, are all kings, Our children, too, belong to the royal race of man, and they well deserve their fine garments, all the more if they learn how to earn and make, as well as to display and wear them.

Mr. J. B. Lyman moved a vote of thanks to Mr. Warren, for his interesting paper, which was unanimously adopted.

Adjourned.

February 22, 1870.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Great Crops of Corn.

Mr. Nathan Pierce, Paulding, N. Y.—It has long been my ambition to raise 100 bushels of good sound corn from an acre. I have tried barn-yard manure in profusion, used the phosphates freely, and been liberal in application of guano and other fertilizers, but always found an impassible gulf between seventy-five bushels and the maximum to which I aspire. I am aware that newspapers often speak of such achievements, but I am a very singular man about one thing—I don't believe everything I see in a newspaper. Let me ask, without offense or doubting, whether any one of you has raised, from his own land, or has known any of his neighbors, I mean from personal knowledge, to raise 100 bushels of merchantable corn, weighing

fifty-six pounds to the bushel, as the product of one acre. I mean, of course, our common kinds of corn.

Prof. J. A. Nash.—In my native town of Conway, Mass., I once saw two premiums awarded—one for 137½ bushels of corn from an acre, and the other for 124½ bushels. In the measurement a single rod was selected, and the estimate was made from that.

Mr. A. S. Fuller.—When I lived in western New York I heard large stories; in fact, one man asserted that he had raised 160 shelled bushels to the acre, but his reputation for truth-telling was not as high as that of the lad in Virginia who hacked his father's cherry trees. In all my travels I have never seen 100 bushels grown on an acre, and I would go a thousand miles to see it, but I am afraid I shall die without the sight. I don't believe this quantity was ever raised from a single acre, either in Sussex or in that Eutopia of the world, that blessed Canaan of the farmer, Salem Co., N. J.

Mr. H. L. Reade.—I live in eastern Connecticut, where tolerably good crops are the rule, and the average there is not more than thirty-five bushels, though we have grown as high as sixty.

Mr. J. B. Lyman.—In all the wonderful tales we hear I notice a square rod was chosen, measuring so as to take in an extra row of hills. This was measured *green* and the amount multiplied by 160. Some years ago the Salem county farmers, believing they could beat the rest of the round world on corn, formed a committee; David Petit was chairman, I believe. they went to all the cribs of the best corn growers, measured the bushels, took the number of acres planted, and ciphered the average result. It fell at sixty-seven bushels, I believe; and this statement I had from David Petit's lips, whose every word I believe, although he plows but five inches deep.

George Geddes is counted as about as good a grain farmer as there is in New York; he often puts fifty loads of manure to the acre of good clover sod, and turns all under for corn. He says he was never able to take over eighty-seven bushels from an acre, and neighbors came miles to look at it, and called it the wonder of the season.

Produce of Eighteen Acres.

Mr. Erastus Kimberly, Monroe, Mich., cultivates eighteen acres of land. He keeps one horse and five cows, three of which he milked during the season of 1869, and in addition to selling $9.25 worth of milk and cream, made 936 pounds of butter, beside

supplying the family of three persons; fatted two veals that sold for eighteen dollars; raised one heifer calf that weighed 755 pounds when she was one year old, worth fifty dollars at our market for beef; fatted 1,451 pounds of pork, sold it for $176.38; raised 220 bushels of corn, 256 bushels of beets, seventy-five bushels of carrots; twenty-one bushels of potatoes, and fifty bushels of apples. Sold from the garden and of small fruits thirty-two dollars worth; mowed eight acres; plowed about four; pastures about four; the balance is taken up by roads, buildings, &c. Has bought fifty-seven dollars worth of mill-feed, but there was as much feed on hand, and has as many hogs as he had a year ago.

CHEESE FACTORIES.

Mr. B. D. Stratton, Winona, Ohio, wrote to say that many of the farmers in his vicinity are turning their attention to this branch of the dairy business, hence any information would be thankfully received.

Mr. F. D. Curtis.—The factory and the requisite machinery for making cheese are usually provided by a portion of the parties interested in the enterprise, who resolve themselves into a joint stock company, under the general corporation law of the State, which company, through their directors or officers, select a superintendent and cheesemaker. In a small concern the cheesemaker could fill both places, taking in the milk, making the cheese, and keeping the accounts. In many places a private individual constructs the factory, and furnishing it, manufactures the cheese, charging the patrons, which is also the practice of the companies, a price per pound for making and curing the cheese, usually two cents. When two cents per pound is charged, it generally includes all expenses for salt, rennets, &c. In some factories this assessment is made upon the cheese when taken from the press, in others when sold, after being cured; the cheese drying out about seven pounds on the hundred; thus, of course, in this latter case reducing the revenue of the company. When the milk of a large number of cows is furnished to a factory, the cheese can be made at a less cost per pound, as the additional expense to a well furnished factory would be only what extra help would be required in handling, and a small expense for salt, rennet and bandages. The whey, an important item, is sometimes fed to the swine of the patrons yarded on the factory premises, an odoriferous practice (which should not be followed), or carted home on the same vehicle which brings the milk, and then mixed with a small amount of meal or shorts, fed to the pigs at home, where the

animals get better care, make better pork, and where, with a little common sense, in the shape of muck and straw put into the pen, a pile of manure can be made which will add ten dollars to the profits on each hog, a good deal to their comfort, and deodorize what is often a pestilential nuisance in the farm yard. The cost of a factory building will vary according to the locality. The one of which I have the honor of being president, in Charlton, Saratoga county, with a capacity, apparatus and storage room for the milk of 500 cows, cost $3,000. The income of such a factory, with an average of 400 pounds of cheese per cow (a high average), would be $4,000, to be reduced by the wages of the cheesemakers, who get from twenty-five to $100 per month, according to skill and demand. To these wages must be added the cost of fuel, muslin for bandages, salt, rennets, annato and insurance. The expense for boxes in which to ship the cheese is charged to the owners of the cheese. The patron is accredited at each delivery of milk with the number of pounds delivered, which entitles him to a certain number of pounds of cheese, to be determined by the ratio of milk to cheese, which is found by dividing the whole amount of milk received for a month, or any given time, by the number of pounds of cheese, which ratio varies from eight pounds to eleven, depending on the season of the year, and the care and skill used in the manufacture. During the greatest flow of milk the ratio is largest, and in the autumn it is less. When the cheeses are taken from the press they are weighed, and the weight and date of manufacture stamped upon them by a stencil plate. When thus arranged it is an easy matter to determine the weight of the cheese when green. A gallon of milk will weigh about eight pounds. The average amount of milk required to make a pound of cheese, take one factory with another, is ten pounds for the entire season. The average price of cheese for the last season, at the factories, has been about seventeen cents. From these data it will be seen that milk was worth at the factories, to work up into cheese, deducting the cost of making, one cent and a half per pound, or three cents per quart. The cost of boxes and shipment would probably average nearly one cent per quart, leaving the net income of the patron to be a little more than two cents per quart. I have said a good estimate for a cow was 400 pounds of cheese for a season, this at fifteen cents per pound would make sixty dollars profit, less the cost of boxes. To this can be added the value of the calf in eastern New York, worth from ten dollars to fifteen dollars, at four weeks old, for veal; but in localities remote from the

large towns worth no more than the meat and skin, and also the pork raised and fattened from the milk and whey supplied from the cow, and the butter made before and after the cheese season. The old rule of "a pig to a cow" will not hold good where cheese is made, unless a little grain is supplied, but three cows will maintain two pigs. A good cow will make ten dollars worth of butter, which, with the calf at ten dollars, and a hundred pounds of pork, a moderate estimate, will figure up the nice little income of ninety dollars and over. It is not common for the owners of cheese factories to buy the milk. Large producers deliver their own milk. Small dairyman, uniting, hiring one of their number or alternating. A word in regard to the comparative production of beef and cheese. It is estimated that the feed which will make one pound of beef will produce twenty pounds of milk, which milk will make two pounds of cheese. A fair average price for beef during the past year in New York city would be fifteen cents per pound retail, and for cheese twenty-five cents. Thus it will be seen that the farmer's grass and grain, when retailed from the butcher shop and grocer's counter, stand to him in the relation of production and sale, as beef or cheese, of fifteen cents to fifty. A number of things would enter into the question of comparative profit between the two, such as the labor connected with the production, &c. One of the nicest points growing out of this relative production would be the comparative benefit or detriment to the soil. Would the raising of a drove of young cattle and their fattening, and ultimate loss to the farm of the material which made the growth, and the valuable constituents which made up their organization, reduce the amount of phosphate and intrinsic ingredients of the soil more than the annual drain to supply the material, and sustain the functions and elaborate the tissues necessary to furnish the required amount of milk. My vote would be on the side of the dairy, as less exhaustive and more profitable. The philosophy and the science involved in this query I leave for the consideration of our philosophers and professors, who are amply competent to digest the subject, and serve us with the facts.

Mr. J. B. Lyman.—I am, for my part, grateful to Mr. Curtis for the full and careful way in which he has met this inquirer. Thousands of farmers all over the country are out of heart about their wheat and their wool, and are looking toward cows and a cheese factory. On a strictly dairy farm, in a good grass country, a place ought to carry

a cow to five acres; a 100 acre farm should carry twenty; 200 acres, forty; and so on. I find that two classes of farmers prosper in dairy districts, those who have 300 acres or more, and can keep cows enough to make it an object to employ a first-class cheese maker, and have a large vat, a good cheese room, and a big drove of pigs. One vat will require about four presses. It will not warrant buying a boiler to make steam. Such a farmer must keep a good many hands to produce corn and make hay. They do just about as much in the field as is done on places where there is no milking to do. The pigs kept to drink the whey will force the farmer to make good crops of corn, and the manure from the pigsty will help him to do it. The development of the factory system has, in many counties of northern Ohio and central New York, raised land from an average of sixty dollars to an average of eighty dollars per acre. Another class of farmers who do well in the factory system are poor men with large families. Such a man can rent a grass farm and manage a herd of from thirty to fifty cows, yet hire very little, except in haying. Every person over eight can milk from two to ten cows. The factory takes all, and takes it every day. There are no delays, doubts or hazards about the income. If the outgo is small, the man grows rich; for, except in haying, a girl of twelve can be of almost as much service in a milk yard as a man, yet not miss a day at the district school, and the best men and women in the country have been reared under just such pressures. The way prices are tending now, I say to every man, whose land is natural to grass, *buy cows.*

Dr. Isaac P. Trimble.—I would like to inquire what anatto is used for.

The Chairman.—To give to cheese the color of Orange county butter, which otherwise would look like a pale luna.

Mr. F. D. Curtis.—The taste of people is so vitiated that they have come to think that cheese that is rich must be yellow. This is not true, but the producer is nevertheless bound to regard the whim.

Deep and Shallow Plowing.

Dr. F. M. Hexamer.—The example farmer of Westchester county gave the following review and judgment as to the depth of furrows: According to the published proceedings of this Club, Dr. Trimble said here at a recent meeting: "I have reports from some who have

taken Mr. Greeley's advice, and plowed a foot deep, and they say, as Dr. Hexamer once said here, that the ground, for the time being, at least, was ruined." Now the spirit or the insinuation of this sentence, as most people will take it, is that, after trying Mr. Greeley's theories of deep plowing, I had found them to do more harm than good, had given up deep tillage and resorted to shallow plowing. As these charges, if they were true, would do myself a personal, material and pecuniary injury, I am forced to deny them in the most decided manner. Next to robbing his customers, I do not know of a more serious charge against the reputation of a nurseryman than that of accusing him of shallow tillage. Everybody knows that plants grow better in deep, loose soil than in a shallow and compact one. Trees and plants from nurseries where deep tillage is practiced, are healthier, thriftier, stronger, and altogether more desirable than those grown on shallow tilled grounds; and no sensible man will, knowingly, buy plants from shallow plowed nurseries. In European nurseries, where the cheapness of labor permits it, fields are trenched by hand labor to the depth of three feet. In some nurseries this operation has been repeated every ten or twelve years, for a period of hundreds of years, to the great advantage of the proprietors. As to the field mentioned by Dr. Trimble, it is true that by plowing it in the spring of the year double the depth to which it had ever been stirred before, the thin top soil became covered with a thick layer of heavy clay, which could not give food to the young plants, and made the field unproductive for that year. I have mentioned this fact not to discourage from deep tillage, but to impress others with the importance of deepening heavy soils gradually. I have given my mistakes and shortcomings with the same readiness with which I have given my successes. Very often the causes of our failures are more instructive to others than the history of success. This same field, however, which Dr. Trimble shows off as a warning example of deep plowing, has since been plowed to a depth of several inches more, it has been thoroughly mellowed and manured, and is to-day the best field on our farm. It is the same field which, when all planted with potatoes, Professor Thurber pronounced the finest field of potatoes he had ever seen. It was on this field Mr. Williams exclaimed: "There is a surprise, indeed!" when he beheld the beautiful strawberries growing upon it. On this field grew many of the fine samples of potatoes, for which the silver medal of the American Institute was awarded at its

last fair; and it was in sight of this field that Dr. Trimble said, in presence of Mr. Crandell, "You have the best of Westchester county." How much of the county he has seen I cannot tell, but the fact is that all those fields on which I raise good crops are tilled deeply, and on those not yet so worked I have not succeeded in growing profitable crops. The other charge, against which I have to defend myself, is the assertion that I have taken Mr. Greeley's advice to plow deep. I had practiced deep tillage long before I knew Mr. Greeley, or his views about the depth of plowing. I have taken Mr. Greeley's advice in many things, and am thankful to him for it; but for what common sense, for what experience, for what science shows as clearly as daylight, I do not require anybody's advice. The very laws of nature tell us to till the ground well and deep. Go over the parched fields of the southern States, made sterile by years of wanton, reckless robbing of the soil and shallow plowing. Ask the mulleins, the liveforevers, and the scrub pines, which find but a scanty supply where once corn and cotton luxuriated. Ask the crumbling ruins which your eye meets on every side, once the comfortable homes of wealthy planters, but long before the war abandoned for new and richer fields. The very drearyness and devastation which surround you exclaim, "Obey the laws of nature." If it was customary in the Club to pass resolutions about the principles of agriculture, I would offer the following:

Whereas, Plants grow better and more luxuriant in light an mellow soils, than in such which are compact and heavy:

Resolved, That in order to bring compact and heavy soils into the most favorable condition for the growth of crops, they should, by plowing or otherwise, be loosened and mellowed to the depth which the roots of such crops may reach.

Resolved, That soils already in a sufficiently loose and mellow condition for the production of good crops, need not necessarily be plowed or stirred deeply.

I trust the foregoing will leave no uncertainty about my views of deep or shallow tillage. But as the Club is severely criticised by the agricultural press for the views expressed here by Dr. Trimble, and by him only, I must put in a word of explanation for them, and it is the only explanation they admit of, namely, that it is an incomplete and entirely one-sided view of the objects and purposes of plowing. No intelligent man can advise shallow plowing everywhere, at all seasons, and on all soils. One object of plowing is to mellow, to loosen, to deepen the soil, and another is to cover manure. Where

the soil, like in Salem county, is already loose enough, this second object of plowing forms the principal if not the only motive for plowing. There experience has given the best rule how to perform that operation. When asked by Dr. Trimble how deep they plowed, they answered: Just deep enough to cover the manure. And this is exactly the best depth for plowing in fresh manure, not only there but everywhere. The tendency of the liquid and solid parts of manures is downward, and were it not for its gaseous constituents, the greatest benefit would be derived by spreading it upon the surface. The tendency of the gases is upward, and to retain them we must cover the manure. Therefore, in order to obtain all the benefit of the manure applied, we must cover it with a layer of soil sufficient to absorb the gases and yet keep it as near the surface as possible. Experience has shown that a covering of two or three inches of soil is sufficient to absorb and retain the gases of a heavy coat of manure. Composted manures, bone dust, and all fertilizers containing none or little free ammonia, are most advantageously used as a top dressing: their fertilizing elements, being in a liquid or solid state, need no covering to retain them. If manures of this class only were used in Salem county, there would be no necessity for plowing there at all; the harrow and cultivator would probably be sufficient to prepare their fields for seed beds. Unfortunately, however, there are millions of acres on this continent not as favorably formed, and there, by industry and labor, man must produce this desirable condition of the soil which nature has lavished upon Salem. By hard work of man and beast, the ground must be broken up and deepened, before hard frost sets in, when the alternate freezing and thawing finishes the work of pulverizing and mellowing. Thus prepared, spring finds the unlucky outsider even with the Salem county farmer. Then his principal object of plowing will be, as there, the covering of manure; with the less soil he accomplishes this, the shallower he plows the manure under, the greater will be his gain. So will we have to toil on, to deepen our acres gradually year after year, until human genius achieves another triumph as great as the subsoil plow, until the steam plow shall traverse our fields by railroad speed, and make the whole earth one garden, one Salem county.

Dr. Isaac P. Trimble.—So long as these much talked of farmers of Salem county continue to double the crops of Westchester county, wet or dry, so long they will continue to be so infatuated as to plow as they have plowed, that they may continue to reap as they have reaped.

BONES AND BONE GRINDING.

Mr. J. B. Lyman read the following paper: Farmers generally understand that if they can apply all the fertilizing matters which are contained in the bones directly to their soils they will give most plants the most appropriate and lasting food. The difficulties in bone manure are two fold. First: The phosphoric acid is so locked up chemically with lime and mechanically with glue, that a process either expensive or lengthy is required to fit them for doing their utmost good. Second: No business permits such frauds. What the community requires is a bone dust either ground very fine, so as to dissolve readily, or prepared for use with acid, and confidence in the bone grinder that he does not mix plaster, or vegetable ivory, or chalk, or salt cake, to any considerable extent with the substance he sells as bone meal.

A bone as it comes from the butcher or the kitchen contains three substances of considerable value. The marrow and the particles of fatty flesh give tallow useful in the arts, and especially in soap-making. This tallow is of no use as a fertilizer, but, on the contrary, covers the particle of bone with a film that renders them slow and inert in the soil. Hence, bones that have been boiled at a moderate heat, so as to throw the oil to the surface, are not injured for farm uses. The white or boiled bone contains glue closely knit with the lime, but a high heat will repel this glue and bring it to the surface, so it can be removed. So there are two sorts of boiled bones, those from which the oil only has been removed, and those from which most of the glue has been repelled. This glue is in its nature like flesh. It contains ammonia, and this is the most prompt and active of fertilizers. Yet because volatile it does not help any crop but the first to which it is applied. After the oil and the glue have been driven out, there remains a chalky substance which crumbles quite easily. It is composed mainly of phosphate of lime. If sulphuric acid is applied the lime leaves this union, and the result is sulphate of lime and phosphoric acid, substances which plants can make immediate use of. The fineness of bone-grinding makes a great difference in the quickness with which it acts. A bit of bone as big as a pea will remain many years unchanged in the earth, and affords plant food very slowly. When in this state of fineness it is useful as an application to vines and orchards, as it feeds the roots slowly and steadily for many years. But if it is desirable to push a crop rapidly, that is to get the benefit of the bone within three months of its application, it

can be done in either of two ways. The coarse bone can be melted down with sulphuric acid, or by running it through a steel mill of peculiar construction it may be reduced to flour.

Until recently bones were generally neglected and wasted in this country. England has been careful of her domestic bones, and a great importer of them from all parts of the world for about thirty years. The rate of production of bones is about a ton daily from 20,000 persons. A city of 100,000 population yields about five tons daily. These five tons are a good top-dressing for forty acres of land, allowing 250 pounds per acre, a fair though not a heavy application. At this rate New York can, with her millions of mouths, furnish bone top-dressing for 400 acres daily. Philadelphia can top-dress 200 acres; Chicago 100 acres, and other cities at the same rate. When 100 pounds of good, honest bone-meal is analyzed it is found to contain forty-one pounds, nearly half, or organic matter, in the form of jelly. This jelly yields five per cent, five pounds of ammonia, which is valued as twenty cents a pound as a manure. It has fourteen pounds of phosphoric acid, worth as much as ammonia; seventeen pounds of bone phosphate, estimated at two cents, and seven pounds of carbonic acid, rated the same as bone phosphate.

Placed in tabular form the figures look thus:

In 100 pounds honest bone-meal:

50	per cent of organic matter, yielding five pounds of ammonia, worth twenty cents a pound	$1 00
14	pounds phosphoric acid, worth twenty cents per pound	2 80
17	pounds of bone phosphate, worth two cents per pound	34
7	pounds carbonic acid, worth two cents per pound	14
2½	pounds insoluble matter, worth	00
9½	pounds lime, worth comparatively	00
100	pounds; worth in the soil	$4 28

The flesh and cartilage on bones as they are collected are of considerable value, as much no doubt, as seventy-five cents to 100 pounds. This makes the nominal substances in 100 pounds of raw bones worth five dollars when properly applied to the soil; that is to say the farmer will not lose money if his bones, in the soil, have cost him $100 a ton.

A short calculation will show our agricultural readers how many thousand tons of most valuable elements, and how many million dollars are yearly wasted in America by the throwing away of bones.

The two cities of New York and Philadelphia alone, thoroughly gleaned, can furnish all the bones that are ground in this country. Nineteen tons are thrown away where one is converted into manure. Are these bones useless to the farmer unless he can sell them to the bone-grinder? Uncrushed and without the application of strong solvents, a bone does about as much good as a stone. It dissolves so slowly and its fertilizing properties are so much in spots, so little divided and blended with the soil, that a farmer might as well let his bones be kicked into fence-corners as to use them whole. There are three ways in which these tough magazines of plant-food can be made useful.

First Treatment.—Collect all the bones you can, a cart-load if possible, break them with a sledge-hammer, and pile them in layers with fresh horse-manure in a pit. Let them sweat a number of months in an active fermentation, the dung being moistened now and then with warm soap-suds. At the end of the ferment or decomposition they will be found much softened, and will crush quite fine on a flat rock under the head of an old ax.

Second Treatment.—Put the bones in a hogshead or a big old gum with tight bottom. The bottom can be made tight by clay well rammed down. Throw in a bushel of strong unleached ashes made mostly from hickory, elm, beech, or sound young oak. Pine ashes have no strength. Put in a layer of bones, and over them ashes till they are covered, ramming down to make all snug. When the gum is full, moisten with soap-suds, keep them in a warm place, as the cellar, in winter, and use enough suds every week to keep the moisture about the same. If a strong smell escapes, cover the surface two or three inches deep with plaster. After some months' soak, most of the bones will be found soft enough to crush fine with an ax-head.

Third Treatment.—Buy a carboy of sulphuric acid. You ought to get it for about three cents a pound. The manufacturer makes a fair profit when he sells at two. Pour a common pail five times full of rain-water into a tight wooden vessel—a dug-out is the best. Add a pailful of the acid, then five pails of water, another of acid, and so on. If you get a drop of the acid on your hands the burning will be quenched by plunging at once into water. Fix a dishing-place, and make it firm with clay. Compost the crushed bones with muck or rotted turf, throwing on enough of the dilute acid to make the pile quite muddy. In two or three weeks dig over, adding more acid. This will reduce most of the bones to a condition in which plants can

feed on them. But where a farmer has some tons of bones, and lives near a railroad, none of these experiments are to be recommended. He will find his advantage in shipping to some grinder, who has facilities for handling and working up bones to the best advantage. For instance, the Lister Brothers, of Newark, N. J., the largest bone dealers in the country, will give from twenty-five dollars to thirty dollar a ton, and sell the farmer crushed bones at thirty-five dollars. Farmers hear much of crushed bone in various degrees of fineness, and find that much more is charged for bone-flour and floated bone than for crushed bone. In what does the difference consist? A walk through the establishment of the Lister Brothers, enables us to answer this subject intelligently. Miscellaneous bones are brought into such a mill from all parts of the world. Here is a reeking mess of sheep-heads, and other bony offal from the butchers. Here is a pile of ox-bones from South America; the flesh was boiled from them in making Liebig's extract of meat. In this shed are skulls; here is a stall of hoofs and horns; yonder in hogheads are the hard hollow bones of oxen, twelve from each animal, the porous end or knuckles cut of by a circular saw, and the middle parts sold to the button and brush-makers at eighty dollars or ninety dollars a ton. A general sorting is made when the bone comes in. Then such as are covered with some flesh and cartilage are thrown into large tanks and boiled till the oil rises to the surface and is drawn off. In handling thirty tons of bones per day, about fifteen barrels of soap-grease is obtained. The bones, warm from the tank, are then handled on a rough table by a gang of rough red-armed women, who could not find work more distasteful, but it pays them $1.50 a day if they are spry. In this handling, the strings of boiled meat are taken off and thrown in a pile, and the bones are sorted in three general grades, the hardest and whitest go to manufacturers, those somewhat compact go to the retorts where they are converted into bone-black or animal charcoal used by sugar-refiners, while the skulls, ribs, and small bones and knuckles go the bone-mill. The flesh is taken to a drying-house or oven, and there dried and half-baked; it is then piled up with nitrate of soda and sulphuric acid, the slag that comes from retorts in which sulphuric acid is made. This arrests decay, and fixes the ammonia in the flesh so it will not escape in the air, but not so the plant cannot take it up.

The dried composted flesh is mixed with the bones in grinding: about one-fourth of the mass of bone flour consists of this dried and pulverized meat. The first set of teeth working something like a

bark-mill or cider-mill, make *crushed bone*, a preparation in which the bits of bone as small as half a kernel of corn, and many of them much smaller. Another set of teeth reduce it to the fineness of Indian meal, as commonly used, and is called *bone meal.* To make bone still finer than meal, that is to make dust or *flour* of it, has long been a hard nut for the bone men. A grinder in Boston mixes the meal with small sharp-edged stones, and revolving both at high speed, the friction of the stones against the bone cuts it quite fine. This is called floated bone. One of the Lister Brothers has invented a mill where very hard steel faces on cylinders, cut like a course rasp, revolve in opposite directions, and one faster than the other. The bone meal falls between these swiftly revolving rasps, and is made as fine as the best family flour. But the steel faces must be renewed once a week if the mill runs constantly. This is the reason why bone flour costs about twenty dollars a ton more than crushed bone. What is the difference in value for application to crops in these three grades of ground bone? The difference is chiefly in *time.* The fine floured bone acts quickly, as much so as guano. It readily dissolves in water, and goes at once to find a plant in the months of May and June, when the growth should be flush and vigorous.

The meal acts more slowly, requiring two or three months to bring out most of its virtue; the crushed bone more slowly still. This is a suitable manure for vines, trees, lawns and permanent pastures. It should be used when the object is less to obtain prompt returns than to permanently increase the richness of a surface. But in the amount of fertilizing matter there is no difference, the contrast being in the months or years during which the money invested in the manure is coming back.

Much has been said in this and other journals of the activity of England in buying bone all over Europe and in America, contrasting their thrift with our languor on the subject. The Lister Brothers last year shipped 1,800 tons to England, and this year the same dealers are discussing the terms of a shipment of 3,000 tons. This accounts for the fact that the average wheat crop of England is twenty-eight bushels an acre; ours fourteen. Every time one of her merchantmen leaves our harbor laden with bone dust drained from our soil to fatten English sod, she works us a national wrong. It is for the farmers of this country to say whether a shame of this sort is to be lasting.

Adjourned.

March 1, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. J. W. CHAMBERS, Secretary.

FRENCH CART HORSE.

Mr. E. W. Shippen, Meadville, Pa.—I have a pair of this breed, one of which weighs 1,350 pounds, and the other 1,400 pounds. In October I walked them over a hilly clay road fourteen miles (including two stoppages for water) in three hours and twenty-five minutes, drawing a wagon weighing 900 pounds, with two mowing machines on it weighing 1,500 pounds. Upon another occasion, with the same load, I walked them over a hilly road ten and a half miles in two hours and thirty minutes. In the same month I hauled with them, on a wagon weighing 1,500 pounds, twenty-two loads sandstone, measuring 788 cubic feet, estimated at 156 pounds per cubic foot, making four loads per day, a distance of three miles (twenty-four miles per day), making an average of 5,580 pounds of stone per load, or 22,320 pounds moved three miles in one day. On the 21st of January, I hauled one load wet ashes, 6,363 pounds, wagon 1,500 pounds, total 7,863 pounds, a distance of three miles, part of the way being up a hill of eleven feet ascent in the hundred. A common load is 800 feet of green white oak lumber direct from the saw, and I have just been filling my ice house, drawing eighty-eight cubic feet ice per load. The livery stable keepers of Meadville have refused to sell me manure at one dollar per load, whilst they would sell it to me at fifty cents per load if drawn with any common team. We have no paved or macadamized roads in this section of the country, they being all clay or dirt roads. If the Clydesdale horse is as showy and as good a draught horse as the French, I hope you will use your influence in having some of them imported, or any class which will improve our present degenerate race of farm and draught horses.

DESICCATED FRUITS.

Mr. Chas. Alden, No. 35 Park Place, New York, showed specimens of fruits preserved by the "Alden process," and explained that this process consists of evaporating the water without causing any chemical change, and leaving every property of value, so that when the fruit or vegetable again absorbs the amount of moisture taken from it it will have all the original taste and flavor. The machine is capable of evaporating the water from four bushels tomatoes or any other

fruit per hour, or 600 bushels per week, employing twenty-five hands, mostly girls, to prepare the fruit, pass it through the machine, pack and label it for market. This process is so rapid, eighty per cent water evaporated from four bushels every hour, that no chemical change can take place, all the saccharine matter in the fruit being retained in its natural state. No chance for dust, flies, bees, or any other insect to interfere with it, and is perfectly clean, as all the work is done by machinery. This is believed to be the first attempt to preserve tomatoes by evaporating the water from them, or any other way except by canning. It is well known that most fruits contain some eighty per cent water, but the tomato contains about twenty-eight quarts water in every bushel. This machine is intended to evaporate and carry off nearly three thousand quarts water from tomatoes every twenty-four hours, leaving the tomatoes in fine condition for pressing and packing, with all the saccharine matter undisturbed, feeling as soft as a preserved fig, which it very much resembles, and will in that condition keep for a long time, retaining all their natural flavor, color and taste; and when so soaked in cold water and cooked are equal to fresh tomatoes and much less acid than the canned tomatoes, and of much finer flavor and free from the poisonous effects of the tin, and can be sold for one-half the price. There is no one fruit more extensively used in this country than the tomato, and, with this new invention, thousands of acres of land will be brought into requisition to supply the demand which will soon be largely increased, as the cost of transportation, when evaporated, will be very small compared to the canned tomatoes; as it takes thirty-three cans to hold one bushel tomatoes, weighing, when packed for transportation, nearly 100 pounds against four pounds the weight of one bushel evaporated tomatoes. The peaches preserved by evaporation are as fragrant as a fresh basket of ripe peaches, and, when cooked, will have the same rich taste and aroma. The evaporated apple looks as white and clean as a fresh cut apple, and, when cooked, will have all the taste and flavor of the natural fruit, quite a different article from the dried apple in every respect. Evaporated potato, onions, cabbage, parsnip and turnips, when cooked, are precisely like the fresh article. Sweet corn, green peas and all other vegetables obtain the same result by passing through the evaporating process, as also the strawberry, raspberry and all other small fruit. No fruit need now be lost even in the remotest parts of our country for want of a market to dispose of it at a fair price. Knowing that it

would require a large amount of money to erect these machines in different parts of the country, I have, continued the speaker, associated with myself several gentlemen fruit growers and capitalists under the name of the "Alden Fruit Preserving Company," with a capital stock of $500,000. The design of the company is to locate these machines in large fruit growing districts remote from a market, where the fruit will be treated and prepared under the supervision of an agent of the company, whose business it will be to purchase the fruit, see that it is properly evaporated, packed and forwarded weekly to the principal depot in this city, or some one of its branches, where it will be examined and labeled ready for sale, every package bearing the trade mark of the company. Each agent will be a stockholder, consequently interested in the success of the company, and every large fruit growing district can have one trustee. The business of the company will be done exclusively on the cash principle, as far as purchases and labor are concerned.

LARGE HOGS.

Mr. John Ferris, Lawrence, N. Y., forwarded the following list of porkers killed in his place the past season, by whom killed, and the dressed weight of each: S. L. Slocum, age, nine months, weight, 400; R. Lawrence, age, eight months, weight, 405; J. Demming, age, nine months, weight, 410; A. E. McEuen, age, nine months, weight, 401; E. Burt; age, nine months, weight, 450. A. E. McEuen killed the hog that sired the above pigs (I herewith send you one of his tusks) that weighed 714 pounds. Two sows, killed by him, weighed respectively 627 and 638. Enos Burt killed a sow fifteen months old that raised a litter of pigs that was taken from her the 1st of October, and she was killed the 15th of January, and weighed, when dressed, 605 pounds.

Mr. Edwin Black, Columbus, N. J.—I think that you who want to know how to make big hogs should put yourselves in communication with some of the Burlington county farmers.

1. Ed. C. Jameson, of Oakford, killed twenty-four; average weight, 446.

2. Isaac Harrison, New Haven, killed thirty-three; their average was 515½ lbs.

3. John Forsyth, of Pemberton, killed ten; average weight, 545.

EARLY MOHAWK POTATO.

A statement taken from the minutes of the Monmouth County Agricultural Society, was read by Mr. J. B. Lyman, showing that the prize of $200, offered by Mr. John C. Conover, for the best acre of potatoes, was given to a field planted with the Early Mohawk. The same paper also showed the superiority of Mr. Richard A. Leonard, of that county, in general farming, and especially in raising potatoes, asparagus, grapes, watermelons and onions. The yield of potatoes was 127 barrels per acre.

Dr. F. M. Hexamer.—The yield is certainly extraordinary. We can get as large crops from the later varieties not fit for table use, but of the early, these figures are unprecedented. Early ripening sorts do not as a rule keep well. The Mohawk is a potato of great value, and improves as winter approaches. Another advantage in growing this sort is that you can dig in time to get the ground ready for fall planting. My Early Roses rot badly.

Mr. A. S. Fuller.—My Early Roses keep remarkably well, none better, which may be owing to difference in soil.

Mr. F. D. Curtis.—Last season I planted Mokawk and Rose with my own hands on my farm in Saratoga county, and when dug the former were found to be twice a large as the latter, and of better quality. I would caution those who have heavy, cold, clay soil, to select some other sort in preference to the Early Rose.

Mr. John Crane.—In my experience, Mohawk does not compare at all with the Rose, nor even with Goodrich, but is about equal to Harrison, which though yielding largely, has not been found good for eating.

Mr. William Williams.—I have grown the Rose from the first on heavy clay soil at my place in Montclair, and have not found the decay which Mr. Curtis speaks of; on the contrary, the keeping quality is excellent, and the table quality first-class.

THE BEST TRUCK GROWER IN NEW JERSEY.

From the same paper an account was read of the gross sales of produce from Mr. Leonard's farm of 100 acres, for the year 1869:

Asparagus	$2,859 71
Early potatoes	2,367 13
Watermelons	1,864 15
Grapes	907 73
Sixty tons of hay, twenty dollars per ton	1,200 00
Apples	422 00

Pears	$42 50
Sweet potatoes and pumpkins	202 91
Poultry	83 50
Stock	61 00
Total	$10,010 72
Deduct freight and commissions	1,764 18
Net receipts	$8,246 54

Mr. J. B. Lyman.—I see that Mr. Stephen B. Conover is here, who has been Mr. Leonard's market-man for many years, and knows how his farm is managed and his expenses. We would like to know about his annual outlay for manures and labor, and his net proceeds on other years.

Mr. S. B. Conover.—Mr. Leonard usually pays about $1,000 a year for his manures. He keeps but few animals, and buys horse stable manure and street scrapings from New York. It cost him about four dollars a two-horse load by the time he gets it on the land. He has found that any rank fertilizer wastes by being left on the top of the ground, and he plows it in with a shallow furrow just as soon as it is spread. His farm help consists of one man and two boys beside himself. He is to be counted a full hand at all times of the year. The labor bill is not over that of three men from April to October at thirty dollars, say $450. By subtracting this and $1,000 from the $8,000, given as gross proceeds, you get at his profits. Last year his sales were over $12,000, yet his crops were larger this year than last.

CHOICE SEED FOR CHOICE CROPS.

Mr. Sylvester Knapp, Sayville, L. I.—My theory is that large whole potatoes are best for planting, for the reason that there is more moisture and richness to give the new potatoes a start, and that the rule with grain will hold with potatoes; better the seed the better the crop, and although by planting small seed you may not see the difference the first year, but by successive planting they will go back so that there will soon be a very marked difference between them and those raised from large and fair seed. As theory is not of so much importance as practice, I will state that season before last I planted a row of peachblow potatoes, putting the largest and fairest potatoes in whole, and alongside I planted a row, taking those about the size of black walnuts, cutting them once in two, and the row of large ones

came up first and looked the blackest and rankest the whole season, and yielded the best crop and largest potatoes.

Mr. H. L. Reade.—William H. Putnam, of Brooklyn, Conn., grandson of the man who bearded the wolf in his den, has increased the average weight of his wheat from thirty pounds to the bushel to 34½ pounds, by sowing the very best seed ; seed that remains after winnowing the grain, and blowing out all the light seeds, sowing about half of the grain of which common farmers sow the whole.

Miss Middy Morgan.—Thorough winnowing is always practiced in England, and there we often go so far as to pick the seed over by hand before sowing.

Wood Ashes.

Mr. C. H. Taylor, of Deposit, New York.—Do wood ashes applied to land permanently enrich it, or do they only act chemically on other substances in the soil to convert them into plant food ?

Prof. J. A. Whitney.—The most direct effect of ashes is to supply potash to growing vegetation, and this takes place in the greatest degree when the ashes are fresh and a large percentage of the potash is soluble in water. Afterward, when the ashes have become leached, the silicates of potash, lime, &c., decompose slowly and yield up their elements for plant nutrition. Ashes may, therefore, be considered a very permanent fertilizer. They also act chemically to liberate other kinds of plant food.

Gypsum or Plaster of Paris.

Mr. O. J. Chase Boonville, Ind.—Are gypsum and plaster of Paris the same thing ? Will it pay to buy plaster at five dollars a barrel and draw it twelve miles to sow on clover ?

Prof. J. A. Whitney.—The two are identical, except that the term plaster of Paris is commonly applied to the finer kind of gypsum after it is boiled and treated with water for making casts and statuary, but there are some kinds of gypsum so impure that it cannot be used for such purposes. Except under rare circumstance it will not be profitable to use much plaster on clover at the cost mentioned.

Scrap Book for Farmers.

In examining the voluminous correspondence, the Secretary frequently has occasion to note that the same question is asked three or four times in the course of as many months by persons in various sections of the country, notwithstanding the fact that the information

wished for has already been published in reply to a still earlier inquirer. Therefore, to save time and trouble to all parties Mr. Chambers submits the following suggestion, which is certainly worthy attention. Let, say a dozen, large stout envelopes be procured (those made of manila paper are the best), these are to be labeled fruit culture, cereal crops, forest trees, milk, butter, and cheese, farm implements, manures, and fertilizers, &c., &c. Into these should be placed the articles cut from the reports of the Club and from other sources. These can be afterward arranged and pasted in a blank-book under proper headings. Any one who follows this plan for a year or two, will find such a collection of valuable information and facts that would be difficult to procure elsewhere.

GREAT IMPROVEMENT IN BUTTER PACKING.

Mr. Moses H. Nichols, Hancock, N. Y., showed a glass jar holding ten pounds, between two shelves held close upon each end with screws. The mouth of the jar is dipped in cloth covered with paraffine, a tasteless white wax, and a lid of soft lead. The pressure of the screws brings the lid to a tight fit, so that air is excluded. The screws also protect the sides of the cylinder. He says June butter just put down will open perfectly sweet in January, that bees will fill such jar, and the honey can be conveyed in comb. It can be used for preserved fruits of all sorts, as the jar can be perfectly closed after taking out enough for the day. This neat and admirable package he can make and sell for $1.50. All present were much gratified with Mr. Nichol's device, and think it greatly superior to the common tub or pail.

SCAB IN SHEEP.

Mr. John T. Waddell, Henry county, Mo., wrote to say that he has 300 fine wool sheep, that are losing their wool, biting and scratching themselves. Some have small scabs and little pimples, and some have no such signs where the wool comes off, but the skin looks smooth and healthy. Would like to know the best remedy?

Mr. F. D. Curtis.—Sheep exposed to cold storms of autumn and winter will often have sore skin, and if fed too heavily on grain when first put up for the winter they will lose their wool, owing to the fever created by the high feed. The appearance of "scabs" and "pimples," as Mr. Waddell calls them, leads me to think his sheep have that infectious disease called "the scab," and the "pimples"

are the pustules made by the *acarus*, an insect which causes this disease by burrowing in the skin. These parasites increase rapidly and cause the poor sheep great torment, under which they will soon pine and die unless cured. This can readily be done by a thorough washing with a strong decoction of tobacco. It would be best to rub off the scabs with a good stiff brush before applying the tobacco water. As soon as a sheep shows any signs of the disease it ought to be removed from the flock and immediately treated. There is no difficulty in effecting cures, and generally from one application.

Care of Young Stock.

Mr. Pope Bushnell, Bethany, Pa.—The rearing of calves was lately touched by a writer to the Club, who gave his method of feeding, I was glad to see it. For many years I have been raising calves with varied results. More than twenty years ago I abandoned the ancestral custom of feeding them and adopted a new one, anxious to do better by the dear little creatures, in order that they might do better by me. If designed for farm stock, they are tied at one or two days old, fed with new milk from four to six weeks, then untied and allowed the liberty of the stable, fed on skim milk twice a day, with what good fine hay they will eat, with a little meal, until after fly time is passed, then turned into good rowen feed, fat and strong, weighing then 350 to 400, and without special care, if well fed, go through the winter hearty, and at thirty months will ordinarily weigh, alive, 1,200 to 1,400, occasionally 1,500.

Every stock farmer is liable to have some late or mid-summer calves. Such ones I place immediately in the stable, allow them to suck all they will twice a day, until four or five months old, when they are sold to the butcher, commonly fetching forty dollars to fifty dollars each, I keep best fed cows, farm principally stocked with young cattle.

In 1868 one of my heifers, two years old, dropped a calf in the fall. It was placed in the stable, allowed to suck twice a day, and after the two first months it was, at noon, fed a little meal, with good mellow apples, at all times allowed access to good fine hay, until near four months old, when it was sold to a drover for forty-five dollars, at the stable, live weight at the time 470 pounds. In the summer of 1869 I fed three calves for market. They all came sometime after midsummer, two of them from one cow; they, the twins, were placed in stable immediately, treated precisely like the one above refer-

red to, until four and one-half months old, when they were sold to the butcher for eighty dollars, at which time their live weight was 890 pounds. The third one was from a two year old heifer, was fed and treated in the same manner as the twins, except that it was once let out of the stable and with its mother driven to the county fair, where, on exhibition, premiums were awarded both to the calf and its mother. When about five months old this calf weighed alive 560 pounds, fetched me in cash at home fifty-five dollars, the buyer, as usual, getting the best of the bargain.

Adjourned.

March 8, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

EXPERIMENT WITH POTATOES.

Mr. Gerard C. Brown, Croton Falls, N. Y., last year planted twenty-seven varieties, and measured the yield of each, giving the result in the following table:

VARIETY.	No. bbls. of seed to acre.	No. bbls. yield to acre.	No. bbls. to one of seed.	No. of hills to bbl.	Per cent. rotten.	Order of maturing.	Price per bbl.
Early Mohawk	1	80	80	50	....	1	$15 00
Harrison	3⅓	83	25	48½	....	15	2 00
Early Rose	1⅔	53⅓	22	75	....	2	5 00
Gleason	3 7-10	72	19	55½	....	25	2 25
Brozee Prolific	1 1-16	66⅔	50	60	....	16	10 00
Garnet Chili	4 9-10	62	14	64½	....	6	2 50
English Kidney	3 9-10	62	17	64	.01	14	2 25
White Peachblow	5⅛	40	7½	100	.02	20	2 50
Pink-eye Rusty Coat	4	55⅛	11	72	....	23	2 00
White Sprouts	3⅓	66⅔	16	60	....	7	2 00
Goodrich	3 7-10	46	13	88	....	3	1 50
Andes	4	66½	16	60	.01	22	1 50
Red Peachblow	4¼	53⅗	12	75	.05	21	2 12
Calico	4	66	16	60	....	24	2 00
Monitor	5½	78½	13½	51	.03	9	1 25
London White	3	44½	14¼	90	....	8	3 00
White Monitor	4	50	12½	80	.05	10	1 25
Ericson	4¼	59	13	70	.03	11	1 00
Cusco White	4¾	72½	14¼	55	.05	26	1 00
Dyckman	4	40	10	100	.10	5	2 25
Samaritan	2¼	44½	20	90	....	12	1 50
Black Mercer	3¼	71	17½	56	.20	19	75
Red Farfarshire	4	70	16	57	....	17	1 00
Sebec	4¾	20	3¾	200	.50	4	2 25
Skerry Blue	3	16⅔	5¼	240	....	18	1 00
Patterson	3	12	4	280	....	19	1 05
White Mercer	3¼	5 5-7	1½	700	.50	13	1 00
Average	3 3-5	67½	19½	59	1.300	....	$2 00

The above results were obtained by averaging the yields of the different varieties, as, for instance, one piece of Harrison gave me 130 bushels to the acre, another forty-eight, and another 100, the average

being eighty-three for the whole, and so with the other kinds. The treatment of all the kinds in each several plot was the same. The land varied from warm, deep, rich alluvial loam, planted middle of April, to cold, northerly exposed, high, stony, and poor soil, two miles distant, planted the 15th May. This affects the yield of most of the varieties seriously, but the comparison is the better sustained. Of course, owing to the drouth, the earliest plots planted gave best results, and, as compared with last year's statement, the Sebec, Goodrich, Rose, and Dyckman seem to have felt dry weather the most. Another fact not to be overlooked, as proved by these experiments, is the folly of planting too much seed. My plan has been generally to plant large potatoes of each sort; those of the newer and more vigorous kinds cut finer than the others, and this accounts for discrepancy in amount of seed to the acre. It is also noticeable that difference of soil and of time of planting both affect the quality of the potato as well as the yield; the early planted were the best. A great difference of profit to the acre between the different kinds is another feature which the curious can readily reckon from these data for himself, and this shows the supreme importance of planting the best.

The Angora Goat.

Mr. A. Eutychides, from Angora, in Asia Minor, came before the Club with specimens of the hair and pelts of this animal. His ancestors for centuries have been engaged in tending these goats, and have grown rich by selling the hair. It was supposed that the Angora goat would not prosper on other continents, but since 1867, he says, "I have noticed that they have been shipped to Port Elizabeth, Cape of Good Hope, at sixty to eighty-two pounds each ($300 to $475), and the colonists have taken it up, in such a good earnest that they exported mohair in 1867, 19,992 pounds; in 1868, 90,295 pounds; in 1869, 344,634, and they expect to increase their exportation to ten times as much in another five years, though their mohairs are not of much value at present, on account of their crossing the thoroughbreds with the native common goats, and clipping their hairs twice a year, I have not the least doubt that in a short time the breed will improve, or they will not cross the pure bred with the common, and clip them once a year. Having seen the success made in the Cape of Good Hope, I have hastened to New York, influenced by the feeling of national love to the United States as a Greek, to be instrumental in introducing this beautiful animal, which is so remunerative to all the

breeders. I will undertake to import for all who wish to breed at $125 each, in any quantity, guaranteed to be thoroughbreds, both rams and ewes. And I shall be quite at their service to give any information for treatment, breeding, &c. I have samples with me, and shall be glad to show them to any who would kindly give a call on me. If any have mohair to sell I will give one dollar a pound, and I can be addressed at 346 West Twenty-seventh street."

Mr. R. H. Williams.—I saw them in Kansas on Senator Pomeroy's farm, and they promise to be of great value. Their wool makes the lightest, handsomest, and most enduring fabric known to the arts, and their pelts when tanned and colored, furnish the loveliest rugs, mats, and cushion covers.

MALE AND FEMALE IN VEGETABLES.

Mr. E. J. Huling, of Saratoga Springs, N. Y., one of the editors of the Saratogian, wrote as follows: Mr. Hamilton Perry, of this village, has a great taste for horticultural pursuits, and he argues that there is a male and a female in every variety of the vegetable world, as there is in the animal. In some varieties this male and female part is combined in the same plant, as it is, for example, in the Wilson strawberry. In the potato, he says, the part known as "the seed end" is the male, and where that portion only is planted, the product will not be as large or healthy as if the other, or "female" end is planted. He says that when he plants the female or stem end of the potato, he never is troubled with the rot, but always has good, large potatoes, and sound ones, too. His theory is that the female end contains a larger proportion of starch to nourish the young plant and give it an early start. I have faith in his potato theory, which he has tested for years.

Mr. A. S. Fuller.—There is not the least doubt that there is something in his theory as to using different ends of the potato, but the idea of sex is not so sensible.

Mr. E. Williams.—All careful experiments have resulted in proving that the seed end is the best for planting.

IMPROVING THE MERINO EWE.

Mr. Newton Edmunds, of Yankton, Dacotah territory.—I have upward of 1,000 grade Spanish ewes. I wish to increase the length of wool and size of body, in order, so far as practicable, to meet the demand for such wool, and the market here for mutton sheep. I

desire to ascertain whether the object can be successfully accomplished without prejudice to the healthfulness and hardiness of the herd. What breeds should be used in crossing, when herds of one or two thousand are kept? From the limited experience I have had in this country, I think there is no State east of the Mississippi river that can successfully compete with this territory in growing wool. Our climate for such purposes I regard as unsurpassed; our grasses are fine and nutritious, and make first quality hay, which can be put in stack at one dollar and fifty cents per ton, and the range for stock is practically unlimited.

Mr. F. D. Curtis.—Spanish Merino sheep are the best for large flocks. The coarse wool varieties require cover in winter, and will not do well in large numbers confined in close quarters. A cross of the Merino with South Down will improve the mutton but not the wool. These sheep would be comparatively hardy. Combing wool, the highest priced wool now-a-days, can be obtained by crossing Merino ewes with a pure bred Leicester or Cotswold ram, graded up to three-fourths blood; but I very much doubt if such sheep would be profitable on the western plains, as they would not be so hardy and as easy kept as the pure Merinoes. They would do well in summer, but I should be afraid of the winter.

MILCH COWS.

Mr. John W. Temple, Lionville, Pa., wrote to say that during the past season his cows (common) brought on an average something more than a net income of $100 each, and he added: "We feed about four quarts meal per day before turning out to pasture, and then slack off gradually. During the winter we have our milk room heated to a regular, moderate heat by a wood stove, into which we put large chunks, which cannot be split for other stoves. On one occasion, in this room, I churned a lot of butter in a common old dasher churn in three and a half minutes, and had excellent butter. We are particular to put nothing but cream in cream cans, *i. e.*, no milk. Wheat screenings (clean) and rye, mixed with corn and oats, I believe to be the best feed. I am trying potatoes now."

Mr. W. S. Smedley, Lionville, Pa., wrote as follows: Aubrey Hoffman, living in an adjoining township, has two cows, great, huge Durhams, from which he is making now twenty-two pounds of butter per week, and from one of which, in the summer season, when in her flush of milk, he has made twenty-one pounds of butter in seven

days. He is a wealthy old farmer, not given to boasting, and without mercenary motive in making the statement, as he has no cows to sell, and would like to procure more of the same sort.

Mr. T. J. Bussey, Macedon, New York, forwarded an account of four cows, milked by him the past season, the average time of calving being April 18. Sold three calves, four weeks old, for $27.25; raised one worth fifteen dollars; butter made during the season, 1,113 pounds, average price per pound, thirty-three cents, $367.29; also made 1,568 pounds pork, at twelve dollars per hundred, $188.16; total, $597.70. Said hogs consist of a sow and seven pigs, being ten days old the 18th day of April, for which I paid thirty-five dollars. In addition to the sour milk were fed with 100 bushels of potatoes, worth thirty dollars; ten bushels of corn, worth ten dollars; ten bushels of barley screenings, worth five dollars; total, eighty dollars. Product of cows, $517.70. Income from each cow, $129.42½. The same cows were fed on nothing but grass until the 23d day of November, when they were put upon clover hay that had been summered over, and a peck of potatoes each, daily, and are making now seventeen pounds per week.

LONG ISLAND LANDS.

Mr. E. F. Richardson, Brentwood, Long Island, forwarded the following statement regarding some of the experiments and results of eight years work on the wild lands of the scouted section: "With my limited means I have cleared some thirty-five acres, have planted some to upland cranberries and other small and orchard fruits. I have tried onions, sweet potatoes, and different vegetables. These, with the principle farm crops, though not on a large scale, have confirmed me in the belief that a large proportion of Long Island plains may be cleared and cultivated so as to pay as good a profit as can be derived from agricultural pursuits in most parts of the eastern States or New York. I would like to show any one half an acre of dry loam land which I cleared and planted with upland cranberry vines six years ago. I planted and cultivated them as I would strawberry vines, with the exception of not applying manure of any kind. The fruit the third year paid the expense of hoeing the three years. The fourth year paid a little more than the cost of purchasing land, planting vines etc., from the time of setting.

The two succeeding years, fifth and sixth, gave a net profit of $136 from the half acre. Gooseberries and other small fruits have

produced equally well. Onions, sweet and common potatoes have produced 200 to 300 bushels to the acre, according to manuring. My first acre seeded to grass and oats eight years ago with sixteen loads of stable manure, produced seven successive years an average of two tons of hay per year, but now needs top dressing or plowing. I could give encouraging and paying results of grain crops or the rapid growth of trees in the nursery to which my attention has been chiefly turned, but lest you should be wearied with statistics or reports from a stranger, of lands in which you may be little interested, I will only add that I am strong in faith that if the depth and quality of the soil on Long Island plains could be known and understood, the value and cost of its products and other advantages be compared with those of other places, these extensive tracts of wild land would not long be known as such, except in the history of the past. I believe there are thousands of acres within two hours ride of New York city which may and ought at once to be turned to agricultural account.

Mr. A. S. Fuller.—If that business of raising upland cranberries can be continued, it is a fact worth knowing.

Report on Richardson's Bee Cottage.

The undersigned, to whom was referred the Improved Bee Cottage, by L. L. Richardson, Webster City, Hamilton county, Iowa, respectfully reports:

That he has examined the Improved Bee Cottage and has heard the explanations of the inventor. The hive is of very simple construction; all of its parts being square, it is easily made by any one familiar with tools.

These hives have movable comb sections which make them convenient to examine the combs at any time. They also have a movable roof, which not only protects the hives from severe storms, but shelters them from the extreme heat of summer. I consider it a very simple and cheap hive.

Mr. Richardson does not allow his bees to swarm, but removes part of the comb sections into a new hive which he sets in the place where the other stood, and supplies it with a new queen of which he keeps a supply on hand. He also recommends giving bees protection during the winter.

JOHN W. CHAMBERS,
Secretary.

FOREST TREES.

Mr. G. Haines, Mount Holley, N. J., writes as follows: I am much pleased with the discussion in relation to the growing forest timber. I have long believed it should be cultivated in many places, and could with profit. If the wish is for fencing and building timber, chestnut is good. Plant at a proper distance for trees, then fill the interstices with seeds for hoops such as hickory, oak, &c. The second year the alternate plants could be cut for keg hoops, thus a crop perhaps equal in value to most other productions can be taken each season until only the standards are left.

Adjourned.

March 15, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

TOWLE'S GRADE AND DRAINAGE LEVEL.

Mr. Hamilton E. Towle, civil engineer, 176 Broadway, gave the Club a short lecture on grades and levels. With a simple instrument which he has made, a boy of fourteen can lay out a road on a hillside on a given grade, or mark off the course of a ditch in which the fall shall be uniform from one end to the other. His level is the usual curved glass carefully made and nicely set. The sights are movable up and down by screws, of which there are twenty threads to an inch; the sights are a foot apart. When the instrument is set and the screws are up, the line of sight is exactly horizontal. If the front sight is turned once around, the line of sight is made to fall one-twentieth of an inch in a foot, that is, one inch in twenty-feet, five inches in 100 feet. Turning the front sight twice around will give you a fall of ten inches to 100 feet, and so on. This level does just as good work as a theodolite that costs $120, and is of constant value to a farmer in leveling sills, giving the same pitch to his yard, and a uniform, grade to hillside roads and ditches.

A FARM SCHOOL FOR GIRLS.

Miss Emma Marwedel, Hamburg, Germany, read a paper urging the importance of a school where girls can learn how to tend flowers, how to make nosegays, how to raise calves, prune trees, tend bees, and work butter. My idea is in some degree new, and I think quite new to your country. One of its leading features is to use the work

of the pupils in such a manner as to make the establishment self-supporting. This idea has been approved in different institutions in England and France, but especially in Germany by Mr. Edward Lucas, who, establishing an extensive nursery on about forty acres of land adjoining the college, tried to give a practical as well as a general theoretical instruction in horticulture. The nursery is entirely worked by the pupils of the school. Fruit trees of all kinds, small fruits and vegetables are cultivated, and there are green-houses. The theoretical instruction includes pomology, botany, geology, agriculture, chemistry, landscape gardening, mathematics, bookkeeping, drawing. The course is formed from two different classes. The time of instruction to secure a diploma for the first class is one year, for the second class three years. My proposed horticultural school shall be founded on similar principles of business combined with instruction. But I wish to take in some higher aims with my institution—the education for family life and for co-operation in work. I intend to do this by introducing a warm and happy home life, a life full of work and duties, but also full of pleasures. Balls, parties, and theatres are not all the year round at hand in farmer's life, and they wont make our life happy. What is needed is to fill our own little rooms—and sometimes the smaller the better—with the bright sunshine, reflected from our own happy heart and spirit. We enjoy life and work, because we understand it and have pleasure in doing it. We have to educate our daughters, and sons, too, not only to be happy, we have to educate them to make home happy, and that wants instruction. The education in co-operation of work is also a want of our time. Co-operation signifies working together by established principles. Our life in family, in marriage, in state, is nothing but co-operation. Co-operation, in its true meaning, demands the most republican, and most ideal self-denial. The most prominent offer has been made by Mr. Robert W. Pearsall, on Oakland farm, Brentwood Station, Long Island, who intends not only to make a present of fifteen or twenty acres of land to the proposed horticultural school, but also of more than $2,000 of the improvements he put on a place near his own. This place contains a small, but very pleasant cottage, a second house for the gardner, and a barn, four acres of land in good cultivation, with bearing fruit trees, quite near the railroad, and its cost is $3,300. May not the Farmers' Club, as a branch of the American Institute, or the horticultural department of the same institution, be able to furnish the $3,300 which are

wanted to buy this place, taking security on it, and rent it till I am able to take it myself? I have pupils announced from almost all the States, and the only pressing want is $5,000, of which nearly $1,500 is subscribed. Some may smile at the smallness of my figures, but all I ask is a chance to begin and show what can be done. I remember that your most successful merchant was a countryman of mine, and that Mr. Astor never despised the day of small things. It is only by doing small things well that we are enabled to do great things. I hear that you have in this city many thousands of single women without fortune. What I propose is to multiply the ways in which they can live without slavery or dishonor. I would open for these thousands other avenues—occupations congenial, wholesome and noble. I would silence that dismal "Song of the Shirt," and replace it by the singing of her who twines the glowing roses, or plucks the purple clusters.

Mrs. F. B. Hallock.—It will be understood that it is the purpose of this excellent lady to make good wives, good housekeepers, good needlewomen, as well as good gardeners, and it seems to me the enterprise is worthy of all commendation and support.

Mr. A. S. Fuller.—There is now an opportunity of ascertaining, by actual experiment, whether a horticultural school can be established which, unlike the agricultural colleges of the country, shall be successful in accomplishing anything of practical value. It is a question in my mind whether, under the circumstances, there is any possible hidden germ of good in this enterprise, and simply for the reason that the girls of our time are, in their nature, very much like the boys of our time, and the boys of our time incline more to kids and canes and hair parted in the middle, than to any useful industry. but I say very cheerfully that I believe in Miss Marwedel, chiefly, however, because she is German, and accustomed to modes of life more homelike and industrious than ours.

Mr. H. T. Williams.—When the notion comes to prevail that labor is *not* degrading, and that brown hands are no disgrace, then there will be more hope for such an enterprise. However, the sons and daughters of the day do not evince an inclination to learn the lesson, and I am not sure that we are doing much to aid them in the good way.

Mr. P. T. Quinn.—I have never yet seen a young man just graduated from an agricultural college who would be likely to succeed in getting a living from a ten or even a twenty acre field, and yet, with

this knowledge—which is a fact not flattering to these so-called educational institutions—I am disposed to think well of Miss Marwedel's enterprise. I am sure I hope she will succeed, and as much as I can I will give her hearty support, and look hopefully forward to better results than the agricultural colleges have shown us.

Dr. J. V. C. Smith.—I, too, approve the scheme, but I do not think at all well of Long Island as the theatre of action. It is quite too poor in soil and too near the city. Let Miss Marwedel go further and fare better; let her seek out the promised land—of course I mean Kansas. There she will find pastures ever new, and not soils that require at the outset a fortune to fertilize. I am so earnest in this, Mr. Chairman, that I would gladly give her a twenty years' lease of a 160-acre tract, and at the end of that time I would, if necessary, renew it for an even longer period.

Mr. A. M. Powell said that Miss Marwedel had come before the Club and stated her plan. He thought it a good one. She was a thoroughly practical and well educated woman, and he had entire confidence in her ability and integrity. At first Mr. Cornell had offered her inducements to settle near his place, but these offers had been practically withdrawn, and the lady was not under obligations to go anywhere in particular. He hoped that the Club would enable her to carry out her plan. Miss Marwedel sought to open a new field for the working girls.

Mr. R. H. Pearsall thought that Miss Marwedel did not wish to establish the Horticultural School of the United States or of Kansas, but of New York. They wished to take the 38,000 unemployed women out of the city. The plan deserved hearty co-operation. The question was: Is it possible to establish a horticultural school for women?

Manure in the Hill.

Mr. J. D. Cree, Landisburg, Penn.—Four years ago I bought a piece of land that was completely worn out; limed and manured it well, seeded it to wheat and clover. According to Mr. Geddes, it is prepared for corn. The quality is loam, and I am anxious to make a good crop. Now, what fertilizer will be the best to apply in the hill. Any information will be thankfully received.

Mr. Wm. S. Carpenter.—Not any manure *in* the hill. A fertilizer so applied, unless the land is very strong, will push the growth of stalk, but when the ears set the roots are away out beyond the hand-

ful of dung or bone, and get nothing just when they ought to get most. At the first hoeing let him top dress with a compost of equal parts dry and fine hen-droppings and plaster, a small handful to the hill. But as a general thing corn finds any manure you put on a field, no matter where you put it. But the more mixed in the better.

Maple Sugar.

Mr. John H. Curtis, Cherry Creek, N. Y., gave some account of his practice. He recommends tin buckets as preferable to wood, but urges the necessity, if these last are used, of keeping them scrupulously clean, which requires more trouble than is the case with tin. He prefers a five-eighths-inch bit to a larger size for tapping, as doing less injury to the tree, and hangs the buckets upon spikes driven into the tree, the buckets each having a lateral ear provided for catching over the spike. Buckets thus suspended do not tip over, are not filled with leaves, and the tree may be tapped at any convenient part, or at any height from the ground, which is not the case when the bucket has to be bolstered upon the ground. He places the sap, as fast as collected, in a reservoir arranged somewhat above the level of the evaporating pan, so that the sap may be readily run into the pan as fast as needed. The reservoir is fitted with a kind of wooden funnel or straining device, having a perforated bottom that separates the leaves and refuse. He uses for sugaring off a sheet-iron pan two feet square and six inches deep. The sirup from the evaporator is suffered to cool so that the settlings will sink to the bottom, whereupon the sirup is turned off clear. In this condition it is placed in the pan, and to each panful is added a teacupful of milk to clarify it. In order to know when it is boiled enough to crystallize into sugar when cool, a few drops of the sirup is poured upon a tin dish. If it can be pulled from the tin without a tendency to stick when cold, it is boiled enough, and may be poured out into the molds. Mr. Curtis lays much stress upon the necessity of being forehanded in the work. The bucket should be laid by the trees in anticipation of the first run of the sap, so that they may be put in place the very first day of the run. When the sugar-making season is over they should be nicely washed and stored in a clean room, and not, as is often done, in some out-building for the hens and turkeys to roost in. Mr. Curtis's letter is abbreviated somewhat, but the Club is much obliged to him for his common sense suggestions, and the practical and thrifty character of his remarks.

Muck as a Manure.

Prof. J. A. Whitney read the following paper:

Muck is a word of broad import. Sometimes it is applied to a coarse and fibrous peat, at others to matter so thoroughly decayed as to show little trace of organic origin. Peat may be used as a mere absorbent, but will not, of itself, contribute much to the present amelioration of the soil. Muck may possess certain inorganic constituents that are soluble, and constantly available for the nourishment of plants, inasmuch as they are the immediate products of decomposition, but the power of the substance in the compost heap will be almost null. True muck, such as the farmer should seek to obtain, and which is the proper material for composting with rank or concentrated manures, is in a condition about midway between the two extremes just specified. In this state it is so nearly decayed that a little more will enable it to be dissolved and disseminated in the soil by the influence of air, warmth and moisture; yet it is not so nearly decomposed as to have lost its property of generating vegetable acids or of absorbing mechanically a considerable quantity of liquid. Such a product will have a rich black color; when dry it will pulverize readily between the fingers, and when exposed to a high heat, as for example, calcined on a fire shovel in a stove, will be nearly all burned away. The ashes, of course, indicate the percentage of mineral fertilizing materials in the muck. These, when the muck is allowed to decompose in the ground, are probably sooner or later wholly available as plant food, but the improving effect of the muck is due in the main to its organic or carbonaceous constituents these, as we shall see, acting both chemically and mechanically in changing the character of the earth in which they may be incorporated.

In origin, muck is simply the product of successive growths, on the same spot, of wild plants, grasses, and forest leaves, that have withered, fallen and decayed, only to be succeeded by other growths springing above them and destined to run the same course, until at last a bed of rotted and rotting vegetation is formed. These accumulations occur in low places, and, receiving the wash from higher grounds, are frequently enriched by soluble mineral matter.

The material in its natural state is soaked with water and impregnated with organic acids, some of them very hurtful to growing vegetation, while others are capable of serving an important purpose at a later stage in making the muck valuable. The efficiency of

muck for agricultual purposes rests, first, upon its mineral constituents, which, as above noted, are, practically, of not much account; and, second, upon its carbonaceous substance, which makes up most of its bulk, and in which its value mainly consists.

In preparing muck for use, the first essential is to deprive it of moisture as far as is possible without too much expense. The best way of doing this is to dig it in summer, and throw it in piles on dry ground with surface drainage and under cover. The next step is to make it fine, and to neutralize any injurious sourness. This is best done by subjecting the heaps to the action of frost, and afterward shoveling them well with quick-lime. If the other conditions have been well fulfilled, two or three bushels of lime will be enough for a cord of muck. When muck is designed for composting, to much lime will do mischief by favoring the elimination of ammonia from its compounds, and their consequent escape and loss. It will be seen from this that the better plan is to dig the muck from the swamp a year before it is needed. This done and our material being ready for use, we may proceed to consider the philosophy of its action when mingled with the soil, and from this deduce the conditions necessary to its use.

Muck ameliorates the state of the ground by the chemical action induced by its own decomposition, and also by changing the texture of the soil, rendering it looser and more sensible to other helpful influences. The material also serves to convey to land various manurial substances which could not be saved or distributed to advantage in any other way. The first class of benefits may be derived from the application of muck alone; the latter class are due to its judicious use in composts.

The action of muck is worthy of study. Many have failed to obtain any advantage from it, and have condemned it as practically worthless, simply for want of understanding its function in the soil and the rules that should govern its application. When we place the decomposing matter in the ground, subject to moisture, to the permeation of warmth, and to the agency of the air, it decomposes still more, and evolves carbonic acid. This dissolves in, or rather is absorbed by water. A solution of carbonic acid acts much more rapidly than water alone upon the minerals existing in the soil, such compounds of potash, alumina, silex, and the like; consequently a greater supply of these inorganic constituents of plant food are dissolved and made available for crops. The action in this case is substantially the

same as that exhibited in green manuring, with buckwheat and other shallow-rooted plants. Further, the minute particles of decaying organic matter possess the power of mechanically absorbing ammonia, and of holding it until, by the continued progress of decay, ulmic and similar acids are formed which combine with it, constituting ulmates of ammonia. These salts, being afterward decomposed by different causes, yield up their ammonia to the root spongioles as the growth of the plant proceeds. Muck therefore, when buried in or mingled with the soil, acts chemically during its decay to hasten the liberation of mineral plant nutrition naturally existing in the soil, and also to hold ready for the plants whatever of ammonia may exist or find its way into the same. This action is identical with that of the decaying vegetable matter, roots, leaves, herbage, etc., found more or less in all land, and known under the name of *humus*. From this it is easy to see how on lands rich in humus the application of muck will produce no marked effect. Such grounds, low bottom lands, and those that have been pretty thoroughly green manured, possess humus enough already, and muck is no manure for them.

There is another result of the use of muck, which is often of more consequence than is commonly supposed. The darker the color of a field the more rapidly will its surface absorb heat, and the greater the absorption of heat the more is hastened the sprouting of seeds, the luxuriance of leaves and stems, and the ripening of kernels. The dark color of a soil is due in the main to its proportion of organic matter, as shown in the vegetable molds to which allusion has just been made. In those instances where muck can be profitably applied, this darkening of the soil is an incidental advantage, especially on certain varieties of lands indicated further on.

The mechanical action of muck in the soil is simply to loosen it, but this ultimately results in important chemical changes directly affecting its fertility. Air and heat can more readily permeate the ground. The natural drainage of surplus moisture from the surface is hastened. This, by diminishing evaporation, helps the warming of the soil, it being a well known truth that the evaporation of one pound of water renders latent as much heat as is required to raise the temperature of 130 pounds one degree. Furthermore, the moisture passing downward insures more uniformly a moderate humidity at a depth of several inches, which materially reduces the injury done by a drouth.

A light, dry and sandy soil, is much benefited by a dressing of peat or muck, especially if the sand is light colored. Such a soil is subject to great extremes of heat and cold. It is parched in the summer noons, and cools rapidly at night. If dressed with humus, this absorbs water, and gives it off when the heat is great, thus cooling by evaporation. At night the dark particles drink in moisture from the air to give it out again under to-morrow's sun. All dark colored soils are warmer on an average than bright surfaces.

A stiff clay soil, if not a wet surface, will be benefited in many ways by a dressing of muck. Its minerals will be more rapidly decomposed by the increased generation and dissolving action of carbonic acid, and inorganic elements of plant nutrition thus rendered assimilable in greater quantity. Not only will ammonia be held by the humus as previously explained, but the soil being rendered more friable and loose, the surface of soil exposed to air, moisture and sun warmth is measurably increased, and in the same ratio its adaptation to meet the wants of growing vegetation is increased. In addition to this, the power of the clay itself to absorb and retain manurial substances is enhanced, and the advantages incident to more thorough æration, disposing of water by downward drainage and darkening of the surface are secured.

There is another variety of land of a very different character upon which muck may be used to advantage. Of such are fields that have been exhausted by cropping, until the soil has the whitish or gray appearance often noticeable on high slopes where the exhaustion is accelerated by the drainage of soluble organic and other matters to lower lands. Such soils bake in the heat of summer, especially if plowed when moist; their æration is consequently diminished, the penetration of the roots is hindered, and their poverty of fertilizing constituents receives almost no help from the natural agencies to which attention has herein been previously directed. This can be obviated by the application of muck to supply humus. This will make the soil darker, favor the retention of moisture, and increase the availability of manures which, in instances of this character, should always be used in connection with the muck.

In these remarks muck has been considered with reference to its own inherent manurial value, this value being due to the supply of humus yielded to the soil by its intermixture therewith. Substantially the same end can be secured by green manuring with shallow-rooted crops, and also, with certain incidental and additional advan-

tages, by green manuring with deep-rooted plants, which, like clover, draw up nutriment from the subsoil, and in stem and herbage leave it upon the surface. It is therefore a question for the farmer whether the one method or the other of supplying humus to the soil will be the most to his profit. When it is remembered, however, that for green manuring the ground practically lies idle for one season, and that the humus resulting from a thrifty growth of buckwheat upon an acre of ground, will hardly equal that provided by two or three solid loads of dry muck, there is good reason to belive that the latter will yield the best return for the outlay. On the varieties of soil mentioned as suitable, muck may be used as liberally as the farmer can afford, but its results must not be looked for all at once. It must be kept in mind that muck benefits land by inducing slow, though sure, chemical changes, and the grain from these changes, shown in the greater luxuriance of crops, must be looked for as coming gradually.

Aside from its value as a direct application, muck is of great importance as a composting material. Nature has made a wise and wonderful provision by which decayed animal matter and dead vegetable stuff, both poisons, one creating typhus, the other bilious, or shaking fever, are made harmless by being mixed, and a manure richer than either alone is the result. In this admirable way man, by knowing the true wisdom of composts, cuts off the springs of disease and makes the earth more productive of food.

Dr. J. V. C. Smith moved that the thanks of the Club be given to Prof. Whitney for his valuable paper, which was adopted.

Adjourned.

March 22, 1870.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Setting Out an Apple Orchard.

D. Purington, of Lacey, Iowa, asked information for setting out an apple orchard.

Mr. W. S. Carpenter.—He should not begin till the ground is in good condition, warm and mellow. When the earth is ready let him take his young trees from the nursery and trim off the roots. If it is six feet high the diameter of the roots, taken as a bunch, should not be over two feet. Cut the tap root. In trimming the side roots

be sure and cut so the severed end will rest on the ground. The thrift of a transplanted tree depends on having the earth pressed close about the wound. As he puts the tree in let him press the earth around the small roots that have been cut. The top should be trimmed also to correspond with the root pruning; remove a third or a half. Never manure in the hole with yard compost. If anything is used let it be ashes and bone dust, but rotted turf is better than either. Then litter or mulch the surface with straw or other trash to the depth of three or four inches. This will carry the orchard through the first year. Then if he manures let him use ashes, half a bushel to the tree, and some lime. But unless the soil is poor it will not need manuring so much as cultivation. When young trees have overborne they should be cut back and the earth fertilized. Clay is good for trees, especially on sandy surfaces; but it is bad policy to dump stuff of any sort into a hole and expect a tree to grow on what you give it there. Fertilizers should be pretty well combined with the whole surface. By doing as I have recommended to this friend in Iowa, I do not lose over one tree in a hundred at transplanting.

IRON FOR PEACH TREES.

Mr. J. E. Wagoner, living on Long Island, some fifty miles east of the city, brought to the Club rooms prunings from his orchard, illustrating the effect of putting iron around peach trees. He took an old place with twenty trees in the orchard, full of dead limbs, with yellow leaves and the crotches oozing thick gum. He gave the earth a good top-dressing of iron, breaking up old plows and stoves, and scattering the fragments. The effect has been marvelous. The trees have renewed their youth, look strong and thrifty; the bark is tight, and the leaves all green, and the borer has disappeared. He thinks the slag of iron furnaces, ground up and spread on orchards, would prove a very valuable fertilizer for all orchards.

Mr. J. B. Lyman.—Some time since Prof. Horsford of Cambridge, told me that by recent tests he had found phosphate of iron on the upper surface of leaves and in the skin of fruits. If they require iron, and none or very little is in the soil, it must be added by the orchardist.

Mr. John Crane.—I believe in iron on the peach. It may not cure the yellows; but it generally gives good high-colored fruit. In many parts of Jersey they have bog mud in which there is a great deal of iron rust. This has always been found an excellent application on peach orchards.

Prof. J. A. Whitney.—A correspondent, Mr. Correy, of McGrawville, N. J., asks whether copperas or sulphate of iron would not be a good top-dressing? I should be careful of it. It is a poison, and should be used, if at all, combined with lime.

Protection of Birds.

The subjoined preamble and resolution was offered by Mr. Fuller, seconded by Mr. Curtis, favorably commented upon by several members, and passed unanimously:

Whereas, The opinion of the agricultural community is divided as to birds, and their friendliness to the farmer; and

Whereas, The wanton and cruel destruction of these little animals, prohibited in some countries by law, is on the increase in this community; therefore be it

Resolved, That this Club inquire into the facts relating to birds, and elicit replies from different parts of the country, and give the public a carefully digested summary of what farmers and ornithologists know respecting the habits of the crow, the robin, the woodpecker, the blue jay, and other varieties that are generally persecuted as enemies or shot wantonly.

The Transportation of Beeves.

Mr. John W. Street, of Marshalton, Iowa, showed upon the board his plan of a cattle car that will take animals through in comfort without suffering. He has a set of gates that swing either way by which the beeves are kept separate, yet not crowded. An iron vessel connected by a pipe to a funnel on the top supplies each animal with water. The car runs under the tank, and in a moment every ox is supplied. There is a double roof and compartment slides by which the person in charge can stand over the animal's head and feed him with hay, roots or grain. Such cars are six feet longer than the others, and cost forty per cent more; but the cattle can come through two or three days quicker, and in so good condition as to weigh from fifty to 100 pounds more than when brought in the old way. It is well known at the west that disorders, such as the Texas plague, come of the cruel way in which the animals we eat are brought from the great plains where they grow. In a talk with Mr. Alexander, the largest cattle dealer in the world, he had been pleased to see that his views were indorsed, and Mr. Alexander would favor the introduction of this much-needed improvement. He thought the difficulty would be with the eastern butchers, who would buy as cheap as possible without regard to public health, and the railroads who are ready to let

well-enough alone, and do not relish being disturbed in their arrangements. But he proposes to pay the road so much a mile for passing the car over the rails, and he will make his profits by the superior condition and full weight of the bullocks when they reach the eastern cities. The pamphlet was referred to the standing committee on the meat supply, one of the members of which has had conversations with leading cattle men and butchers about the city, among others Mr. De Voe, who say that an animal brought to market in some more humane way would sell for five per cent more on account of his good condition, not to speak of the gain from increase in flesh.

Green Crops for Soiling Cattle.

Mr. Frank D. Curtis read the following paper: The importance of an abundance of green feed for cows is not generally appreciated by dairymen. But a small portion of them practice any sort of soiling system whereby to increase the flow of milk, trusting to the labor of the animal to supply herself, and forage enough to make herself a profitable investment. Great is their faith! In the summer's heat and the autumn's cold, when flies are multiplied and frosts make herbage scarce, all is left to the instincts and inclinations of the cow to fill herself and the milk-pail, without coaxing nature and making the enterprise sure by bringing to the feed-box of patient brindle, in a comfortable spot, a supply of succulent green feed, where her energies shall be expended in producing and not in obtaining. To the stock-breeder who is obliged to keep some of his animals confined through the summer, green feed is an absolute necessity. Corn fodder is extensively grown, and is most excellent for our purpose. With a clean, rich soil, it may be sown broadcast at the rate of three bushels to the acre. Four bushels of seed to the acre will make finer stalks and prevent the weeds from growing so much, for the reason that the ground will be more thoroughly shaded. Corn fodder raised in this way can be cradled in swaths, and, being bound up in small bundles and placed in stocks, will dry nicely, and is splendid feed after frosts come, and will cure sufficiently to be put into the mow and kept until winter. For young colts, calves, and lambs during the winter, such fodder is exceedingly nutritious, and almost invaluable. The seed can be drilled in, or covered with a cultivator and the ground rolled. Planting corn closely in drills is the safest way to get a crop for fodder, as it can then be cultivated, and I should recommend this way unless the ground is very mellow and free from weeds. The disad-

vantages with corn for fodder is that but one crop can be obtained, and the season is far advanced before that one is ready. For this reason many farmers thinks it does not pay, which is a great mistake. It should be grown for a late feeding green crop, to increase the income of the dairy and to keep up the good condition of the young animals. Lucern (*Medicago sativa*) is a leguminous plant of great antiquity and color. It was a favorite of the Greek and of the Agricola of the Roman empire. The French agriculturist esteems it highly, and in our own country it will doubtless prove the *sine qua non* when its rare qualities shall be generally known. In South America it is known as Alfalfa, a difference only in name. It will grow in the same climate and soil with red close, but needs stronger land, and, being a native of southern Europe, requires, to perfect itself, more sunshine and warmth. This peculiarity can be remedied to a considerable extent by a rich soil, a warm exposure, and stimulating manures. When furnished with these advantages, its rapid growth, and the amount of lucern which can be taken off from a small piece of ground is most astonishing. From four to six crops can be cut in one season from the same land. For flesh forming and nutritive elements it is superior to red clover, containing 50.7 parts, to 41.2 in clover. Like clover, it covers the ground with a dense shade, thus enriching the soil while the roots strike down into the subsoil to the depth of several feet, defying drouth, and leaving the land in admirable condition for subsequent cultivation. Lucern resembles clover in appearance, with a smaller leaf, and, if left to ripen, has more woody stem. I would not recommend it to take the place of clover for general purposes, but I do most emphatically indorse it for a soiling plant to meet the great want of the dairyman and stockbreeder. For horses it has special merits; not being soft and washy they are not liable to scour on it. It is perennial. Once get it rooted, and with a clean soil it will thrive for years, yielding its successive burdens of richness. The seed is larger than clover seed, and when ripe and fresh, glossy and yellow, as the sample shows. They can be obtained of any first class dealer at fifty cents per pound. The crop may be sowed with grain, rye being the best, but it is preferable to sow alone; from eight to ten pounds of seed to the acre. Mr. Robert Gibson, the well known farmer and herdsman at New York Mills, has had an extensive appearance with the cultivation and feeding of lucern, and may justly be called the veteran in its introduction and successful tillage in America. The large stock at New York Mills is

fed in summer on this grass, and their condition is proverbially excellent. Mr. Gibson says, "the great point is to get the crop started." To do this successfully it is best to plow the ground deeply in the fall, after some hoed crop, and then again in the Spring, so as to thoroughly pulverize it and fit it for the reception of small seeds. The seed should be put in as early as possible in the spring to get the start of the hot sun, that is, so that the young plants may have growth enough to shade the rootlets. The surest method would be to sow the seed in drills wide enough apart to allow the rows to be tilled with a cultivator or horse-hoe, and the weeds and other grasses removed, or they will choke out the lucern. This plant is exceedingly sensitive in this respect and if it is expected to last for years it must be protected from the encroachments of all such interlopers. Two crops may be taken off the first year. So rapid is the growth that the stalks will attain the length of from one to two feet between the cuttings. Like all other leguminous plants, lucern makes extensive drafts upon the atmosphere, and its roots, penetrating down into the subsoil, draw up from beneath both moisture and valuable elements of growth. The farmer should select for his lucern patch a spot of ground handy to the barn, where the snow, nature's covering, will be likely to lie still during the winter; and then, if he has been painstaking in his culture, he may have an abundance of that which will gladden the eyes of the restless bovine confined in the solitary stable, and fill to overflowing the milk pail of the dairy maid.

Mr. J. B. Lyman moved a vote of thanks to Mr. Curtis for his valuable paper which, was unanimously adopted.

Fertilizers for Corn.

Mr. William Newton, Henrietta, New York: Having been engaged last season trying experiments with different manures on corn, and as corn planting is drawing near, I thought a report of the result might be of interest. The pieces of ground on which these experiments were made were as nearly alike as possible, each consisting of ten rows of corn, extending across the field and containing two-fifths of an acre. The soil is a gravelly loam. Each piece received the same treatment with the exception of the manures applied. The field had been mown two years before it was plowed for corn. Piece No. 1 received no manure. The other pieces were manured in December, before the corn was planted, with eight two-horse loads of well-rotted barn-yard manure to the acre. The results were as

follows: No. 1. Without manure. Yield of piece, twenty-one bushels—fourteen bushels sound and seven bushels of soft corn, or at the rate of only thirty-five bushels of sound corn to the acre. The quality of that called sound corn was not first rate. (The yield in bushels of ears and not of shelled corn.) No. 2. Manured in December with barn-yard manure. Yield of piece, twenty-eight bushels—twenty-three bushels of sound corn and five bushels of soft corn, or at the rate of fifty-seven and a half bushels of sound corn per acre, being a gain over No. 1 of twenty-two and a half bushels of sound corn per acre. I leave out the soft corn in estimating the grain per acre. The other pieces received, in addition to the barn-yard manure, the following additional applications: No. 3. Poudrette, made by composting night-soil with about four times its bulk of swamp-muck, and turning the compost two or three times to insure a thorough mixture. The corn was first dropped, about one quart of the mixture dropped on the corn, and the whole covered with two or three hoefuls of earth. The yield of the piece was thirty-six bushels, thirty-four bushels sound, and two bushels of soft corn, or at the rate of eighty-five bushels of sound corn per acre, being a gain over No. 2 of twenty-seven and one-half bushels of sound corn per acre, and over No. 1 of fifty bushels per acre. No. 4. Muck and manure. A compost was made of one-third manure and two-thirds muck. This had lain about one year. A small shovelful was applied to each hill in the same manner as in No. 3. Yield, thirty-one and one-half bushels, twenty-seven and one-half bushels sound, and four bushels soft corn, or at the rate of sixty-eight bushels of sound corn per acre, being a gain over No. 2 of ten and one-half bushels of sound corn per acre, and over No. 1 of thirty-three bushels per acre. No. 5. This was manured with an article I purchased call superphosphate. Yield, fifteen and three-fourths bushels, nine and one-half bushels sound and six and one-fourth bushels of soft corn, or at the rate of only twenty-four bushels of sound corn per acre, being eleven bushels less per acre than No. 1, on which no manure was applied. This article appeared to be composed almost entirely of the flesh of dead animals; there might have been some bone in it, but if there was, the proportion was so small I was unable to discover it. This was first dropped, then covered with earth, and the corn planted on that. No. 6. Ashes. The ashes was first dropped, then covered with earth, and the corn planted, the same as No. 5. Yield of piece, nineteen bushels, fourteen bushels sound and five bushels soft corn, or at the rate of thirty-five bushels sound

corn per acre, or the same as No. 1, the ashes appearing to destroy the effect of the manure applied in the preceding winter. The quality of the best corn on the two preceding pieces was not first-rate. No. 7. Superphosphate. This was made by first burning the bones, then pulverizing them as finely as possible, and then dissolving them with sulphuric acid. The proper proportions are eight pounds of burnt bone to seven pounds of acid, the acid to be diluted with an equal weight of water. This I made myself. It will require to be mixed with either muck or gypsum to dry it so that it can be handled. Yield of piece, thirty-five bushels, thirty-two bushels sound and three bushels soft corn, or at the rate of eighty bushels of sound corn per acre; a gain over No. 2 of twenty-two and one-half bushels, and over No. 1 of forty-five bushels of sound corn per acre. This was used at the rate of about 125 pounds per acre, at a cost of about five dollars. The corn and superphosphate were dropped in the hill together and covered. No. 8. Horn dust. This was procured from a comb factory and applied as in No. 7. Yield of piece, twenty bushels, ten and one-half bushels sound and nine and one-half bushels soft corn, or at the rate of only twenty-six bushels per acre, being nine bushels per acre less than No. 1, and so much worse than nothing. Nos. 3 and 7 had about twice the quantity of stalks there were on No. 2, and No. 4 about one-half more than No. 2. Nos. 3, 4 and 7 were cut September 28, and were ripe. The others were cut October 13, and were not ripe at that time. It will be seen that the poudrette and superphosphate, with the small quantity of manure applied the fall previous, gave an increase of about fifty bushels per acre, while some of the others were worse than nothing. The yield is not large on any of the pieces, as our season was very wet and cold, and the ground so wet the corn could not be properly cultivated. Now, I have no poudrette or superphosphate for sale, so no one need write to me for any. I give the process of manufacture, so any can make it if he wishes, and know what he is applying, and not chase dead horses with a little gypsum mixed with the flesh for superphosphate, as I did.

PEANUT CULTURE.

Mr. C. Grove, Middlesex, Penn., would have information on this subject, and thinks an answer might "confer a favor on many youthful readers of the reports." L. Dow, Salina, Ky., and two or three others evinced similar interest.

Mr. A. B. Crandell.—A North Carolina correspondent of The Country Gentleman, recently gave some account of the mode of cultivation in his vicinity. The land, after receiving a dressing of lime, which is considered the best fertilizer, is harrowed and laid off in checks of twenty-four to thirty inches. Planting is done from the last of April to the 10th of May, two kernels being placed in each check together with a shovelful of barn-yard manure. Cover as corn and cultivate both ways, keeping the surface flat, and not in ridges or hills. Work the ground often enough to prevent weeds until the vines begin to spread and the peas to form. Then leave them to mature. If thrifty they will soon monopolize the soil. Seed may be had in Newbern or Wilmington at $2.50 per bushel. There is an article giving full details of the business in the latest annual report of the Department of Agriculture.

Mulching Sixty Years Ago.

John Daws, Imlaystown, N. J.—I have read with profit the discussions of Geo. Geddes and Mr. Boyd on the advantages of covering the surface of the ground. I have been an observer and a lover of farm knowledge for thirty years, and some of the best ideas I ever obtained came from a book that is now sixty years old. I bought the book when I was tending mill, and read it as the grist ran out. It is Ackerman's Repository, an English magazine. He published a prize paper, by W. Lester of Paddington Green, on the relation of chemistry to farming, and the passage has done me so much good I have thought it might profit the readers of the Club. It has benefited me hundreds of dollars; it made me a convert to mulching long before the farm writers of this country started the word, or began to preach the benefits of it. The farm I am on would not rent for over $125, twenty-two years ago, when I bought it; now it will command a rent of $1,500 a year. The secret of making money by farming is to reach important results by inexpensive means. The best manure is not bone but brain. Here is Mr. Lester's idea:

"I had occasion to dig a pond in a field upon my farm, which had been recently inclosed, to pave the bottom of which I had between twenty and thirty loads of stone picked off the adjoining lands, and shot down out of a cart, as near together as possible. They lay in this situation about fifteen months. As I had found a more eligible spot to make the pond in, I then removed the stones for the purpose

they were at first collected. The adjoining land had been cultivated and manured in a husbandmanlike manner. It was at the time of sowing when the stones were removed, and the ground on which they lay had been plowed up and sown without receiving any manure. To my great surprise, the crop on this spot was more luxuriant and productive than on any other part of the field; the cause of which, I presume, was from the stones having sheltered the earth in some degree from the sun and air, which was, by some chemical process in nature, thus fertilized. From this I inferred that any substance that would thus exclude the sun and air from the surface for a given time would render the earth more fertile. Acting on that conclusion, I used the veitch as a mulch, and found an increase of twelve bushels per acre of wheat.

"I have invariably observed that whenever a rick or stack of hay, corn faggots, stubble, or any other thing, has covered the land only a few months, and although every particle of such matter may be taken away, that spot will be rendered more fertile than any of the adjoining land, even in a high state of cultivation. Hence I conclude, that some chemical process in nature takes place, by which the food of plants is either generated, or rendered soluble in consequence of the exclusion of the air. That there is a combination in the arcana of nature by which the food of plants is rendered insoluble, is obvious to every reflecting mind. Without this the earth would become a desert, and the waters unfit for the existence of fishes, or for the use of terrestrial animals. There is also a dissolving principle by which a part is prepared for the food of plants, and a part is washed off the highlands and carried down by the rivers to enrich the meadows below. It is in this system of the soluble and the insoluble, that we are to find the key for unlocking the treasures of the soil."

CULTURE OF FOREST TREES.

Mr. E. D. Williams, of Harpersville, N. Y.—Having two acres of hillside too steep for profitable culture, and not producing much pasture, I propose to plant it to hickories, and I would know how to proceed.

Mr. A. S. Fuller.—Plow the ground and plant the hickory nuts in rows five feet apart. Sow the nuts thickly at first and thin them out as they become crowded. Plant in autumn, and fresh nuts, for those too well dried will not grow. Cultivate the trees for two or three

years, or until they begin to shade the ground. Here, as elsewhere, careful culture will pay much better than slovenly culture.

Mr. F. W. Dexter, of Randolph, N. Y.—I am going in the spring to that beautiful but almost treeless State of Nebraska, where I have 100 acres, the most of which I would be most glad to put into forest. You speak of the ailanthus as a rapid grower. Where can I get the seed, and how shall I grow it? I am also anxious to learn how to treat and take care of mountain-ash seed until time to sow it?

Mr. A. S. Fuller.—Ailanthus seed can be obtained from B. K. Bliss & Son of this city, especially if applied for in autumn. The seeds will grow as readily as pears, and may be sown in the same way; only do not cover more than a half inch deep. Mountain-ash seed may be kept mixed with sand and then placed in a cellar until ready for sowing. If the mountain-ash seed are sown in the open ground, the bed should be partially shaded; if not, the young plants will be burned up by the sun when they first appear. The north side of a hedge, or under a screen of some kind, is the best place to raise the plants. When the trees are one year old they may be set out into the nursery rows.

Mr. H. A. Weaver, of Liberty, Ohio.—What are the timber qualities of European larch? Will it grow large enough to be ripped into boards, and will it grow as fast as yellow-willow?

Mr. A. S. Fuller.—Larch will make first rate fence posts or rails, and is very durable. It will grow large enough to be ripped into boards in about thirty years. It will not grow as fast as yellow-willow, but is a far more valuable timber, but not equal to locust.

The Peerless Potato.

Mr. E. D. Hinds, Brandon, Vt., sent some of the Peerless potato, which were distributed for testing to Dr. Hexamer, Mr. Wm. S. Carpenter, Mr. P. T. Quinn, Mr. P. J. Ward and Mr. J. C. Thompson.

Adjourned.

March 29, 1870.

Nathan C. Ely, Esq., in the chair.

Early Rose as a Keeper.

Mr. Spencer Springsteed, Unionport, N. Y., sends a basket from the bin in his cellar to show how well they have wintered. They

came out as smooth, firm, and hard as they were the day they were dug. He put up forty barrels, and has not found a dozen rotten potatoes.

Mr. H. L. Reade stated that his experience with these potatoes was the same as Mr. Springsteed's. Last fall he had put up some, and on opening them a week ago he did not find a peck of rotten ones. He considered this variety the best for keeping purposes. They were the best kind also for planting in sandy land.

DRAIN TILE AND DRAINAGE.

This subject was brought up by a communication from Mr. A. Pearce, Arlington, Va., who wished to be informed as to the feasibility of making tile on his own farm. Would hydraulic cement answer? The chief object is to save money; and inch and a half earthen tile in that vicinity is worth thirty dollars per 1,000.

Dr. J. E. Snodgrass.—The whole region of country from which our correspondent writes needs to be thoroughly drained; but I expect it would be better to patronize some public establishment than to undertake to manufacture tile, or a substitute for tile, at home. I am informed that a shrewd Quaker has recently put up a tile factory on the outskirts of the Mount Vernon estate, and probably he will supply his neighbors at fair rates.

Mr. P. T. Quinn.—Our friend will find it better to use good quality of clay, and make the usual drain-tile. If five or six farmers will combine they can get a machine which they could operate themselves at odd times. I have bought much tile at fifteen dollars per 1,000, but if I had occasion to use 50,000 more, I should certainly get a machine and make them myself, and thus save money. There is another idea about drains which has recently come to my knowledge, and that is the practice of using hemlock boards. A neighbor lately told me that he had just lifted a drain made of this material, and put down twenty-two years ago, and he found the timber still remarkably well preserved. The drain was put down the same as horseshoe tile, and he said he likes it better than ordinary two-inch tile, and that it costs less. I would advise our correspondent to look about Georgetown and see what he can buy hemlock boards for, and if he can get them as favorably as we can get them in Newark his drains need not cost him more than a cent and a half a foot.

Dr. Isaac P. Trimble.—My convictions, the result of many years close study of the theory of farming are well known. I believe in

shallowness. There is no wisdom in going deep. I am opposed to disturbing with drains or with plowshares that cool, firm subsoil that never smelled air, never saw the light, never basked in the sun. I advise this man not to drain at all. It will cost him fifty dollars per acre, and I don't think it will prove profitable. If he has none but land that needs draining, why he had better seek a home elsewhere.

Mr. P. T. Quinn.—And I, a practical farmer, and not a sidewalk theorizer, advise this man to drain by all means, commencing in a small way, with half an acre, and I venture to predict if he does this much the present year, that next year he will wish to extend the good work over two or three acres, and so on until his farm is entirely reclaimed.

Mr. J. B. Lyman.—The father of upland draining in this country is John Johnson, of Geneva, N. Y. In a conversation with that veteran agriculturist, he told me the other day that his uniform advice to farmers asking it is to dig one ditch and lay down the usual horseshoe drain. He has had eminent success with it, and does not want a better material. A drain is a receptacle for water as well as a conduit for carrying it. The concrete is used with success in room of pump logs or of lead tubing, but not as a substitute for the usual drain tile. As to the distance apart and other practical questions, Mr. Johnson recommends one trial drain. That will settle more questions than any book or paper on the subject. As to abandoning a soil because it needs draining, as has been suggested, Mr. Johnson says that no soil is really good for wheat that is not stiff enough to be benefited by draining. Mr. Pearce had better unite with three or four of his neighbors and buy a tile machine, and if their clay is free of stones they might also get a ditching machine. But I would not recommend this outlay till he and those who join him have demonstrated that their surface is greatly benefited by drains. It will not pay for them to import their drain-tile from any distance, and Virginia needs local working artisans. Ships have been slowly working her downfall for 200 years; but drain-tile and manure, stock, and diversified industry, will build her up again.

Saving Manure.

Mr. Nathan Whitten, Etna, Me.—"As the chief and all-important subject for farmers is manure, I propose to give my mode of operation in winter. I keep, the present winter, eleven head of neat stock and two horses. The droppings of the stock are thrown

under a shed, and that from the horses is spread over the entire mass. This is done every day. Once in three or four days I spread over the heap a small quantity of lime, putting about a cask during the winter, and, on alternate days, a coat of plaster. My reason for my process is, the horse-manure promotes fermentation, as does also the lime; the plaster retains the gases. This has been my practice for a few years, and my manure is as ripe by the 1st of May as it formerly was in September. I am no chemist, but have been led to this process by experiment."

ASPARAGUS.

Mr. A. Perrine, Englishtown, N. J., asks information in relation to the culture of asparagus as a field crop; what soil is the best; also the best fertilizer, how deep and how far apart should the roots be planted?

Mr. P. T. Quinn.—Deep sandy loam, well-rotted barn-yard manure, or, in the absence of that, something that comes as near to it as possible. Plant either in spring or fall, in hills three by three, or in rows four feet apart, and hills two feet distant, using Conover's colossal, and covering the crowns only four or five inches deep. I speak of the last point, because if he intends to send to market he will get it eight or ten days sooner than if he follows the advice of some, and covers a foot or more. Getting into market early with asparagus is apt to make a great difference in the price, and consequently in the profits.

Mr. D. B. Bruen.—I have the best asparagus bed in this or any other country; there can be no doubt about it; I put it down with my own hands, twelve inches apart, using well-rotted cow-manure. I never allow the sun to shine on their roots. I apply a bushel or so of salt each year, and, when the sprouts die in autumn, cut them off and cover the surface with four inches of mulch.

Mr. Moulton.—How long will a bed last when once fairly put down?

Prof. J. A. Nash.—On the Mount Pleasant property, in Amherst, Mass., there was an asparagus bed which I know to have been in full bearing and excellent for thirty years at least. But a very successful grower, near London, told me he found it best to renew every twenty years.

Mr. Simeon Baldwin.—And on the homestead where I was born there was one at least fifty years old.

Rev. Joseph Wilson, Little Falls, N. J.—As often as I have passed through the market-places and seen the *white trash* that is universally sold as asparagus, I have felt vexed, alike at the stupidity of the gardeners, and the thoughtlessness of the buyers; and have several times remonstrated with the market-men on their improper mode of gathering the asparagus, by which hundreds of tons are worse than thrown away. But, probably, regarding me as an old fogy, they have invariably neglected any advice. It must be known to every one using asparagus, that the white part is not edible, because of its toughness. All you can do with it is to suck a little of the juice and then throw it to the hogs. This is altogether the fault of the wrong mode of gathering it for use. From the appearance of the branches I have seen, I conclude that as soon as the stalk appears above ground a long knife is thrust into the ground and the stalk cut as deep down as possible. Now, that part of the plant below the surface is hard and tough, and consequently is a dead loss. My plan is to let the stalk grow from eight to twelve inches above ground, and then to go along the bed and snap off the stalk with the fingers, as far as it is tender and will break square off. The consequence is that the whole stalk is as tender as a green pea, and can all be eaten. For my use I would not give a cent a bunch for the white stuff, however pretty the ladies may think it. My wife and daughters would not cook it. They, as I do, prefer it tender and green, and would throw the white trash to the hogs, who are by no means complimented for having that for their portion which even they cannot perfectly masticate. Gentlemen, try my plan, and you will have "asparagus as is asparagus."

Absurd Requirements of City Consumers.

Some allusion being made to the practice of cutting asparagus deep down and taking up much of the white, which is useless for any purpose. Mr. A. S. Fuller said there is great need of certain reforms in prevailing practices touching the marketing of vegetables and fruit. For instance, rhubarb is sent with the leaves on, and the consequence is the stalks wilt five times as fast as they would were the leaves removed at the time of cutting, because evaporation goes on through the leaves. And yet the buyers would probably refuse to take the stalks from which the leaves are removed. The fact is, the people must be educated to give up these and similar absurd notions.

Mr. P. T. Quinn spoke in the same vein, and cited celery as another instance. The custom requires that celery be put up in fan-shaped bunches. To put it up thus and do it rapidly requires great skill and long practice, and yet if the same celery is put up in round parcels it would sell for something like ten or fifteen cents less than if put up in the approved fashion. Of course this is nonsense on the part of the consumer.

Georgia.

The Chairman.—We have a gentleman from Georgia, Mr. Samuel A. Echols, of The Rural Southerner, published at Atlanta, Ga., with us to day. I invite him to speak on the agriculture of Georgia.

Mr. Samuel A. Echols, said he had only dropped in with the intention of listening and learning; nevertheless, he was very glad of the opportunity afforded to say something for the section of country in which his lot is cast. My paper, he continued, is as yet in its infancy, and the same, to a great extent, is true of our improved agriculture. Hitherto we have had, so to speak, only to drop the seed and gather the harvest, but now a different system must be adopted, for the soils do not longer smile by being simply tickled with the hoe. Still the southern country is a very inviting one; quite superior, from an agricultural point of view, to the rougher regions of New England and the other States at the north, and what is needed is energetic men to come in and possess the richness of the land. We want accessions of the brown handed from the more sterile climes, and will gladly welcome any and all, and this I know is the sentiment of every Georgian. The young men to the manor born are getting into better ways; they are working instead of being waited upon, and this fact is full of promise. We accept the situation as we find it. We fought for a separate government, but we are not without attachment to the government of our fathers. Slavery is dead, and we are frank to say that we are better off without it. The south never realized more from a cotton crop than she has pocketed this year. Mr. Echols further stated that many of the best citizens of the State are northern men, and he closed by predicting that with the new accessions of this class which is certain to be made, Georgia, and, in fact, the whole broad south, will yet be a country second to any in capacity or charms.

Mr. Andrew S. Fuller.—For my part, I am glad to see this young Georgian among us. He, and all like him, who believe in a new epoch for the south, a brighter day, a truer system, sounder ideas, and a just economy of the powers of nature are welcome, and if we can aid them by words uttered, or words printed, we will be glad so to assist. There is hope from the young men of the south. They are not haunted by vague regret and dim visions of a faded glory and splendors now traditional. They are not brooding over old wrongs, and asking whether there is a protection from a just God. The old planter will never take lessons from a northern farmer in anything, because that would be to admit that northern ideas may be better and sounder than southern ideas. But the young man of the south, he who honors labor and is not above work himself, will come, in time, to understand and adopt a system that will lift their acres from a value of ten dollars to a value of $100. Thorough tillage, blooded stock, and big manures piles will do it in Georgia as they have in New Jersey and New York.

Cranberries.

Mr. F. S. Abbott Sharon, Penn., and Mr. Augustus Parker, Westville, Conn., make inquiry in relation to the culture of cranberries.

Mr. J. B. Lyman.—The best soil is a cold, black muck. The land must not be made too dry. If cut with ditches, these should be kept half full of water; and a dam is necessary to flood the patch in winter and to kill worms. The best results follow a top-dressing of white sand, the cleaner and whiter the better. Sand does good in two ways. It keeps the patch clean of grass and weeds, and it keeps the muck below cool and moist. The top-dressing of sand should be renewed once in two or three years. The plants can be obtained by applying to Mr. Ephraim Empson, New Egypt, N. J., or Mr. Frank Todd, Bricksburgh N. J. They cost about two dollars a barrel, and you set out eight barrels to an acre, like cabbage plants, two feet apart each way. If you have sand mixed with the muck naturally, and the ground is too wet, plow, harrow, and set out; then keep clean with the hoe and hand.

Adjourned.

April 5, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

MANURES FOR COTTON.

Mr. F. D. Curtis stated that a friend of his Mr. Thomas L. James, recently purchased a farm at Aiken, S. C., the soil of which is suitable for cotton, which staple he is anxious to cultivate, but as there is dearth of home manure he must look elsewhere, and would like the Club's notion as to what he had better buy.

Mr. A. S. Fuller answered, guano or bone dust.

Dr. Isaac P. Trimble alluded to a discussion he listened to last summer, when some Georgia planters were assembled. A variety of opinions were expressed, some thinking that guano soon runs out, and others that bone-dust is not reliable, because so apt to be adulterated. In conclusion, Dr. Trimble remarked that the southern cultivators should pay more attentien to the economizing of what home manure they have, and also to take measures to increase the amount by better practice.

Mr. J. B. Lyman.—Cotton needs two sorts of fertilizers, one to push the growth, and another element to ripen the seed and give long and silken staple. We cannot expect many cotton bolls on a small plant, nor choice cotton from small, withered seed. The stuff that will push the young plant is not that which will do most for the seed and staple. For instance dry Sea Island guano, for which he will give ninety dollars a ton, will push the young plants, but it burns and wears out the soil. Coarse bone is slow. Fine bone is as good a separate manure as he can buy. A fragment of bone as big as a grain of wheat will do the first crop no good. A piece as big as a grain of corn will be two or three years unchanged in the soil. Let him make a mixture of a bushel of plaster, a bushel of bone-flour, and a bushel of guano. This will fertilize, yet not exhaust. But no bought manure will give advancing fertility to a cotton field. He cannot afford to buy enough. Muck, yard manure, rotted turf and leaves, should be his dependence. He can call in the commercials as allies. But you cannot enrich a place by bagfuls.

HOW TO KEEP CATAWBA GRAPES.

Mr. E. M. Conklin, Westfield, Ohio.—I write to inform the Club that I have kept my Catawba grapes all winter, and have some left

yet just as fresh as when cut from the vine, by simply laying them down in a box. First lay a paper, then a layer of grapes, selecting the best buches and removing all imperfect grapes, then another paper, then more grapes, and so on until the box is full; then cover all with several folds of paper or cloth. Nail on the lid and set in a cool room where it will not freeze. I use small boxes, so as not to disturb more than I want to use in a week or so. Give each bunch plenty of room so they will not crowd, and don't use newspapers. Some seal the stems with sealingwax and wrap each bunch by itself, but I get along without that trouble. I presume other varieties will keep as well, but I have not tried them as yet, but will another year. The grapes should be looked to several times during the winter. Should any mould or decay, they should be removed and the good ones again repacked. By this means I have had, with my pitcher of cider and basket of apples, my plate of grapes daily, besides distributing some among my friends and the sick of the neighborhood.

Salt for Sheep.

Mr. D. M. Fisher, Arch Springs, forwarded the subjoined item of experience: I had as fine a flock of Grade Southdown sheep as I ever saw. I took a notion to not salt them, thinking salt of no use. About six months after they began to decline very fast; the finest of them died, and they all looked poor and ragged. After this thing had gone far enough to convince me that they would all die, I commenced to salt them again, and have not lost a sheep since.

Watermelons.

Mr. E. Haines, Mount Holly, N. J.—I will give the mode of growing watermelons in lower Jersey, where they are produced largely and with little labor. First, clover sod on an inclined plane preferred. Second. With a small plow mark nine feet across the plane. Third. With a large plow make deep dead furrows the other way, same distance apart. Fourth. Put plenty of long manure in the furrows, but not under the hills; tramp well. Fifth. Throw the furrows back. Sixth. Tramp the ridge at cross furrows; make fine; drop a handful of rich fertilizer; then about a dozen seeds; cover about one inch. Seventh. When stand secured, pull all but two. Eighth. Plow the land only as the vines require room; let grass grow; keep the ridges clean; at every hoeing tramp round the hills. Ninth. When the fruit begins to set, turn

the vines and plow shallow (the land previous to this having been turned up); spread the vines. Tenth. Keep clean around the hills; rough farming, with some weeds or grass between the hills for vines to cling to; if they blow over the sets will come off. Where there is no sod, spread a heavy coat of long manure between the hills as soon as planted. An incline plane preferred, because the water in heavy rains will escape quickly.

HORN DUST AS CORN MANURE.

Mr. J. H. Foster, Kirkwood, Camden county, N. J., a small fruit culturist.—I notice that one of your correspondents has not succeeded well in the use of "horn dust" on corn. I should think such horn dust would be hard to adulterate, and at a loss to account for the result. It is true he informs us that the horn dust and corn were dropped in the hill together. I know of a whole field planted thus which had to be replanted; but in this case no complaint is made of such a result, only the lack of ears of corn.

My experience with horn dust is such that at eighty dollars per ton I would consider it the cheapest manure in the market. Perhaps I should tell what horn dust is *here*. The factory is in Camden, N. J. The horns are mostly "rams' horns," said to be gathered in South America. At first, machinery was used to cut the horns into small thin chips, but it was too costly a process of reduction.

The process now used is as follows: The horns are subjected, while kept wet, to steam under pressure for several hours; then dried by fire heat; and finally reduced by grinding. The steaming and drying make them brittle. The grinding reduces the horns to pieces not larger than wheat grains, and much of it is finer. After being steamed the horns are very soft, almost like jelly.

My experience was with half a ton. I had a piece of sandy soil on which I had tried to grow corn fodder for winter use in '67. It was sowed too thick in the row, about fifteen grains per foot being used, and the fodder raised from one and one half to three feet high. Rye was sowed after the fodder was cut off. It hardly paid for cutting and shocking. By May 20, 1868, the rye was from six inches to two feet high, and in head. It had been sowed with the intention of plowing it under to aid in improving the soil, but there was little to turn under. I sowed horn dust on the ground at the rate from 600 to 1,000 pounds per acre, putting more on the gravelly knolls

than on the other parts. It was plowed as deep as two horses could do it, for I believe in deep plowing on these sands. I think it was plowed ten inches deep, but of course all the "dust" was not turned under to that depth.

Corn was sowed in rows not three feet apart, putting about ten or thirteen grains to the foot. It came up nicely, but grew only moderately for about three weeks. I almost distrusted the voice of science, for it said that horns were the richest animal manure, and I felt confident the manufacture was honest.

But during the fourth week it grew more than all the previous three weeks, and in the fifth week made as much progress as in all of the previous four weeks. I never saw corn of such a dark color before.

I have, within the last eight years, raised nearly twenty acres of corn-fodder for winter use and for soiling, but I never raised any which grew so fast as this little plot.

We commenced using it by August 1, by cutting out about half the stalks in each foot of row. The remaining stalks had ears on, many being of a fair size, say nine inches long. These were used when in the "dough" for fattening pigs. The average height of the fodder was from five to ten feet. In the above there is nothing very accurate as regards measures, but in using it on potatoes at the same time, several manures were used, each at the same money value, thirty-five dollars per acre. Horn dust proved cheapest. I have not the figures at hand now. It not only proved cheapest, but it proved to be a profitable application. It was composted with fresh muck for three weeks. The compost was spread on the uncovered seed, and the whole covered with plow, as marl and manure compost is used in this section of Jersey.

Fish Culture.

Mr. L. S. Seaman, West Liberty, Ohio.—I have a never-failing and bounteous supply of spring water in what I consider a favorable locality for fish-breeding. I hope you will give me some valuable information on the subject of pisiculture. Where can I obtain publications of interest containing facts and trustworthy statements relative to the subject? Any information will be gratefully received.

Mr. J. B. Lyman.—In 1858 Dr. Garlick, of Cleveland, wrote an excellent book on this subject which is now out of print. The most available treatise that he can get hold of is the article on pages 319

to 347 of the annual report of the Department of Agriculture for 1868. Some of the States have appointed commissioners to attend to the restocking of their lakes and rivers. Their reports would be interesting reading for Mr. Seaman. Let him address, with stamp inclosed, the Hon. Theodore Lyman, of Boston, or Mr. William Clift, Mystic Bridge, Conn., or, Dr. John M. Crowell, No. 273 Fulton avenue, Brooklyn, N. Y. The two last mentioned generally keep trout eggs and small fish for sale. Every man who has a good clear brook or a deep pond under his control, possesses the basis of a small fortune in fish if he will but acquire the necessary information, use the proper skill, and exercise due kindness and patience.

Broom-Corn.

Mr. Noah Dear, Montezuma, Ind., and several others have written to know how to begin with this crop, and how to cultivate it.

Mr. J. B. Lyman.—Begin with two quarts of seed, put it on your richest corn land, leave eight stalks to a hill, and cultivate just like corn. If the land is cold and late, you want some rank manure, as hen dung or guano, on the young plants to give them a push; otherwise they will look sorry and pale all through June. When the seed is formed, but before it gets full and heavy, "table" it; that is, bend the stalks over toward each other about three feet from the ground. Then with a sharp knife cut off the broom, leaving a foot or two of stalk below the bush, and lay in small bunches on the table as a scaffold to cure. There are several ways of getting the seed off; none of the machines are costly. You need some shed and barn room in which to complete the curing. It is of no use to put broom-corn on any but dry, warm and rich land.

Distance of Trees in Orchards.

Mr. Sam. A. T. Anderson, Bear Lake Mills, Michigan.—We wish to derive the greatest profit from both land and trees, and ask the Club for its opinion.

Mr. John Daws.—If his land and climate are right for peaches and apples, I will tell him how I do and he may follow it or not. I find my profit in it. I set my peaches and apples in alternate rows 16 feet apart each way, keep the ground wholly clean and sow nothing but buckwheat. On the strongest land and with the use of manures, I put in a row or two of potatoes and perhaps tomatoes, till the young trees are big enough to shade the surface. By that time the roots

want all there is there. I use a compost of marl, lime, and unleached hickory and oak ashes. I calculate the peaches will do all the good they ever will in ten years. Then I cut away and give all the space to the apple trees, which will be 32 feet apart. As to varieties of apples, I have found more profit from a sort called "Smith's Cider" than from all the fine greenings and pippins. Smith's Cider will bear right along year after year, and are worth to me $20 a year from each tree.

UNMOTHERLY EWES.

Mr. D. Hane, of New York, desired hints touching the management of ewes which repulse their infant offspring; also, what he shall do when a ewe is willing but not able, because of having minus quantity of milk.

Mr. F. D. Curtis.—I have always had good success in raising lambs when their mothers gave little or no milk, by letting them suck a new milch cow. Let the keeper take the lamb between his knees and put the teat of the cow in the lamb's mouth, and squeeze it gently to force the milk out. Ample opportunity should be given to let the lamb breathe, or it will strangle. Care must be had not to overfeed, but feed often. Always have the same cow. When a ewe will not own her lambs, confine her in a pen with her offspring, hopple her so that she cannot jump, and in a few days she will take to the lamb. At first the ewe may have to be held to let the lamb suck.

FARMS FOR CITY BOYS.

A gentleman who lives in New York, and has a son who is willing to try life on a farm, asked for information as to where he could find an opening. Mr. F. D. Curtis suggested that as there are probably many other fathers and sons in the same humor, doubtless it would be well to organize some plan by means of which those who want help and those willing to work may be brought together without the expense of agencies.

Mr. J. B. Lyman.—The subject has intrinsic difficulties as well as considerable importance. If he goes with a poor man he may find him a poor farmer, and thus learn bad ways rather than good. If he goes with a good farmer, who is considerably known and honored, he will be likely to find refinements and manners like those of city homes. Such people will either treat him too well; i. e., make a guest of him, and leave him with a false impression as to what success on the soil demands; or, they will treat him as a servant and

stable boy, and that would be as bad as the other way. Boys that are put out to do farm chores for their board generally hate farming, and make good speculators, or peddlers, or politicians. Suppose, for instance, he has been nearly all day in the hay field, or following a horse in the corn, comes to the house and finds some young company. Can he go and put on a white shirt, wash his face and be gay for an hour, or is he to keep on his old clothes, feed the pigs, milk his two cows, and measure out the oats for the work horses as soon as they cool. Farmers often take a grim pleasure in putting a bright-faced boy who says he wants to be a farmer, at work which is about the hardest and meanest on the place; he sprouts potatoes in the cellar, shovels green manure, hoes corn, suckers tobacco, and picks up stone. Can you expect a lad to be anything but disgusted with such a life? If we send city boys to farm, let us send them where they will find some bread that is not crust, and some meat that is not bone.

Mr. H. L. Reade.—Some years since I took a vagrant boy from these streets, and found a home for him on a farm. He is now a hard-working, honest and trusted citizen, prosperous, and known through the town where he lives for a good farmer.

Dr. F. H. Hexamer.—The chief difficulty is in giving boys a love of nature and a taste for rural life. The average city lad is lacking in this, and here is the difficulty. But if some care is used, such enthusiasm may be infused.

Dr. Isaac P. Trimble.—Among the Quakers the placing of a city boy with a good farmer is quite common, and some of their finest men have been reared in just this way. But they honor agriculture beyond most of other people, and look to it as the true life of the good man, most blessed to himself and most useful to his fellow men.

The Chairman.—This subject is one of importance, and as suggested, I will appoint Mr. Curtis, Mr. Lyman, and Mr. Reade a committee to report on some method by which the boy may find his farmer, and the countryman be set in correspondence with the lad he is looking for.

How Premium Corn Crops are Measured.

Mr. S. E. Todd, Brooklyn, N. Y.—When I was on a farm, a distant neighbor won the premium on one acre of Indian corn, which had been offered by the county agricultural society. A few years after the man who gave his affidavit before the officers of the society that he husked and measured every bushel that grew on that acre, dis-

closed the trick by means of which he gained the award. He said: "They filled a bushel basket with ears, just husked, by laying them as closely as they could lie; and all the interstices were filled with pieces of ears; that one bushel of ears was then shelled, and the grain weighed. He was then directed to husk the corn, and measure the ears in that basket, as they were thrown in promiscuously as fast as they were husked, and every basket of ears was estimated to yield many pounds of grain as the first bushel, which was measured in the trickish manner alluded to. By this trick one acre was reported to have yielded 122 bushels of shelled corn." Another successful competitor was known to have carried stalks bearing large ears from another part of the field, the butt ends of which were stuck in the ground, in the rows of premium corn. I have met with so much trickery in measuring the ground, or the grain, or both, that, like our friend Fuller, I never believe the reports of great yields of grain, even when an affidavit accompanies the statement.

Tree and Fruit Culture.

Mr. J. K. Lansing, Greenbush, N. Y.—How shall I proceed to get a field which has some quack grass into best condition in shortest time for fruit trees and small fruits?

Mr. A. S. Fuller.—Plant with some hoed crop, such as corn or potatoes, and cultivate thoroughly this summer and the land will be all right in the fall. There is no cheaper or better way to destroy quack grass than by using the hoe or cultivator.

Mr. J. W. Hillman, Greenwich, Washington county, N. Y.—I am going to plant a pear orchard of 100 trees. What varieties shall I select?

Mr. A. S. Fuller.—Twenty each of Bartlett, Beurre de Anjou, Lawrence, Seckel, Duchesse de Angouleme.

Mr. S. Henry, West Lebanon, Penn.—What is the best time to bud peach trees, and how; also, best time to cut grafts and set them?

Mr. A. S. Fuller.—Peaches are usually budded in July and August, but this depends on locality. Grafting is done in spring, but the details of both operations cannot be clearly shown in print without aid of illustrations.

Mr. I. Basye, Rockport, Iowa.—How can I grow black locust from the seed.

Soak the seed in warm water two or three days before sowing, and sow in drills as you would peas in the garden.

DEATH OF MR. SETH BOYDEN.

Mr. P. T. Quinn spoke as follows: The horticultural community will regret to learn of the death of a great and good man, Seth Boyden, at his home at Clinton township, Essex county, New Jersey. Mr. Boyden, some years ago, turned his attention to the improvement of the strawberries, and signally succeeded in this, as in the many valuable inventions by which his name is now well and favorably known throughout the length and breadth of this country. Mr. Boyden, after many years' patient labor, enriched the horticultural world by introducing respectively the following named varieties of strawberries: Green Prolific, Agriculturalist, Boyden's No. 20 and No. 30. These berries are widely and extensively planted, and the last named is one of the most promising new varieties now on the list. Therefore,

Resolved, That the Farmers' Club of the American Institute deeply regret to learn of the death of Seth Boyden, and feel that the horticulturists throughout the country will mourn his loss.

Resolved, That a copy of these resolutions be forwarded to the surviving members of the late Seth Boyden's family.

These resolutions were passed unanimously, after which Dr. Isaac P. Trimble moved that Mr. D. B. Bruen, an old neighbor of the deceased, be requested to present, at some future meeting, a paper in which there should be fuller mention of the achievements, discoveries, improvements and characteristics which made Mr. Boyden so well known and highly esteemed.

Adjourned.

April 12, 1870.

NATHAN C. ELY, Esq., in the chair; Mr. JOHN W. CHAMBERS, Secretary.

SULPHURIC ACID.

Mr. O. H. Coots, Morrisville, Vt., wants to know the price of sulphuric acid. His druggist charges him ten cents a pound for it, and he sees it quoted in the papers at a lower rate. Has thirty bushels of bone to dissolve.

Mr. J. B. Lyman.—I am familiar with a manufacturer on Staten Island who informs me that he now sells it by the quantity at two and a half cents per pound, and hopes to be able to make it for farmers' use at two cents.

Prof. J. A. Nash.—With such a small quantity of bones Mr. Coots could hardly afford to work them into superphosphate.

Prof. H. E. Colton.—The great trouble about cost of sulphuric acid is its transportation. If near water it is cheap, but the railroads charge enormous rates. The carboys cost more than the acid. They charge three dollars for them, and allow the same price on their return. His druggist's price is not unreasonable, considering these facts.

Culture of Forest Trees.

Mr. William H. Ball, of Wisconsin, desires to know what is the tree to cultivate on the western prairies for lumber. Thinks the locust would be best. Also, desires to know of Alsike clover.

Mr. William Lawton agrees with him as to the value of the locust, but thinks that if he will wait for the black walnut to grow it will in the end pay best, as its fruit and wood are both valuable.

The Chairman refers the correspondent to A. S. Fuller's "Forest Tree Culturist."

Alsike Clover.

Mr. S. E. Todd.—My experience is that Alsike clover is the best for wet lands; that in the forest it has taken the place of Red-top, and the farmers generally like it best, though there are exceptions.

Mr. F. D. Curtis.—I do not like Alsike clover. It has proved a failure wherever I have tried it. It is a beautiful plant, but will not stand in the winter as well as common clover.

Management of Bones.

Mr. J. M. Speer, Boonville, N. C.—Can you inform me what the loss is in the value of bones for manure by burning them so they will come to pieces? I live so far from a railroad (five miles) that I cannot get bone dust easily. I have a common bark mill, but do not know whether I can grind them in it or not. What can I afford to give for bones per pound? I want them to go on a young apple orchard.

Mr. J. B. Lyman.—If you burn the bones you lose all the nitrogenous matter. Open your bark mill and crush them as fine as possible. You may have to break some of the larger bones, and may have to run them through several times, with your mill tighter each time. Then make a compost of swamp mud, hard wood ashes, barn-yard manure, and your crushed bones. Throw on it all the liquid manure

you can from time to time. This will "rot" the bones and make you a very superior fertilizer.

GRAPES.

Mr. David Palmer, Batavia, N. Y.—I take the liberty of asking you if there is sufficient encouragement for profit from vineyards to warrant planting at this time? I am induced to ask this question, inasmuch as I have been told the country is already overstocked with vineyard. What varieties shall we plant? Have you ever seen the fruit of the Eumulan grape? Some agents are selling these vines here, but we have never seen the fruit, and people are apt to be a little suspicious of new things.

Mr. A. S. Fuller.—There was never since the grape interests were first awakened in our country a more favorable time to commence the cultivation of a vineyard than the present. Our people of America are rapidly getting accustomed to having grapes upon their tables, and the demand for good grapes is increasing much faster than the supply. Grapes of good quality, which reach the market in proper condition, are sure to command paying prices. Unlike all other small fruits, grapes can be kept in a ripe state, ready for the table, during weeks, or even months, after they are gathered. At the same time they can be used for the purposes of preserves, jellies, pies, &c., equally well, and, for such as insist upon having some sort of daily beverage, the pure wine made from grapes is much more healthy and far better adapted to strengthen and invigorate the system than any of the thousand mixtures now so extensively used. Regarding varieties, I would say plant mostly early sorts. The experience of the past few years has proved that early grapes are most profitable, as late kinds are often entirely destroyed by frost. But few localities will ripen Isabella or Catawba oftener than one year in five, and most places never at all. Iona is highly prized where it succeeds. Delaware has become a general favorite. Hartford Prolific and Concord are succeeding over a larger extent of country than either of the above named. The Eumelan grape was shown before this Club in perfection early in September last, and was the earliest and best grape shown here during the season. Nearly every member of the Club was so well pleased with it as to plant more or less of this variety. I have one Eumelan vine growing which was set out when this variety was first sent out, and it has so far proved itself well. I would advise planting this variety in preference to any other of the new

kinds with which I am familiar, and I suppose every kind of any merit has been sent me for trial.

Mr. J. B. Lyman.—I can fully indorse Mr. Fuller's views of the grape business, which seem to me entirely correct. Our people want more fruit, and especially more grapes. The large cities are the principal markets, but scores of smaller cities and towns throughout the land are large consumers, many of the New England towns receiving large consignments of grapes from as far west as Sandusky and Kelly's Island. As a general rule the early sorts pay largest and most regular profits. I would say to our Batavia correspondent and others who have good localities for growing grapes, that they may feel well assured of satisfactory profits from a vineyard of early sorts well cultivated and well cared for. There is as much encouragement to plant the Eumelan as any other of the new sorts. We are well assured of its earliness; also of its superior quality; while its general reputation for vigor, hardiness and productiveness should entitle it to the first position among all varieties of recent introduction, and much preferable to Hartford Prolific, Concord, and others of like class, which are not better than second or third rate in quality.

Dr. Isaac P. Trimble presented a report from the Committee on New Jersey Marl, which read as follows: "It will be remembered that about a year ago the Squankum Marl Company of Monmouth county N. J., presented forty tons of their marl to this Club for distribution. Soon after the Pemberton Company of Burlington county presented us fifty tons. The notice given by the reporters caused a great number of applications for portions of this marl. Forty tons, twenty for each company, was delivered at Jersey City. The remaining fifty tons were left at Newark, N. J. A notice was published in a Newark paper notifying farmers and gardners that they could have small portions by calling for it. In a few days all was distributed, each person leaving his name and address, and being required to promise to make careful experiments and report results. Some have reported verbally and some by letters; of the last, I have three of most importance. The corn, potatoes and most other crops having been planted before the marl was received, but a part was used at the time. Some was applied on grass last fall and some this spring. Others who used it at the time will probably reap more benefit this season than last. For these reasons the present report can only be partial to the farmers in the south half of New Jersey. Such a distribution of marl for experimental purposes would have been useless. It has made its

mark there so unmistakably that no future testimony was required; but reports have been made that it was useless on lands of a different character, and would do no good in the higher lands of New Jersey and other States. Several marl companies of New Jersey have invested large sums of money in draining, uncovering, and building machinery, and some of them have made many miles of railroad to connect them with the network of roads. They are now ready to distribute to an immense amount, and as the supply is without limit, of course they are anxious for a market. This gift to us was intended for such general distribution as to test its value on all soils and to correct the impression made by the reports of its being of no value. On some crops, especially clover, marl acts as promptly as even the commercial fertilizers; but on others it appears to have but little effect at first, but will appear in subsequent crops and last for years. The letters alluded to were from Messrs. Bruen and Mackuet of Newark, and S. H. Young of Boonton; the first and last named speaking of marl as a preventative of club root in cabbage.

Mr. H. L. Reade desired to know if this marl could be obtained at such rates as would pay the farmer in eastern Connecticut to use it.

Mr. J. B. Lyman.—The Squankum and Freehold Company will deliver their marl or green sand as near any of the railroads in New York as tide-water will allow, and that any one could form an estimate of the value of the article. He will state that in one hundred parts of marl there are about seventy-five parts of useless insoluble matter, and twenty-five parts of valuable fertilizer, composed of carbonate of lime, potash and phosphate of lime. I know that it pays well to transport it 200 miles by boat, and that it is now being used with great success and favor on the Hudson, at Rhinebeck and above. If there was an apparatus invented to concentrate its valuable matter into a smaller space it would bear transportation over the railroads in bags for indefinite spaces. The man who would invent such a machine could make a fortune from it.

Prof. J. A. Nash.—I will even go further than Mr. Lyman. If there is even twenty per cent of valuable matter in the marl it will pay transportation, for that is more than is in most of the commercial fertilizers. In the marl the buyer was sure of twenty pounds of matter which would be of use to him.

Prof. J. A. Whitney.—There is a great deal of discussion as to the relative value of manures. If one bought the article potash in its concentrated form it would be cheapest, and would not be able to get twenty pounds as valuable in any other form.

Prof. H. C. Colton.—Since the interesting lecture of Prof. Cook, before the Club, I have been examining into the marls or green sands of New Jersey, and am satisfied of their great value. In my native State we have an abundance of shell-marl, but I think it would pay many of our planters to get the green sand of New Jersey rather than dig their shell-marl. Much wood is brought from Western Virginia and North Carolina in small sloops and schooners which might load back with marl. As now it contains more valuable matter than most fertilizers, and if concentrated as Mr. Lyman says would be far superior to any of them. Marl warmed up cold, wet lands, and was especially a valuable manure for cotton.

Cornell University — Address by Prof. Gould.

Hon. John Stanton Gould, late President of the New York State Agricultural Society, and now Professor of Agriculture in Cornell University, was introduced by the chairman with the remark that he was one of the buttresses of the above named institution. Professor Gould responded by thanking the audience for the compliment conveyed through the chair, and said he was glad to be able to state that the university was in the way of doing great good, and in no respect to a greater degree than in that pertaining to agriculture. He would refer in his remarks more especially to the pressing necessity of a greater thoroughness in the education of farmers than now obtains. It is the one thing needful. There is, he was sorry to say, but the whole truth might as well be told, an inability on the part of the agricultural community to grasp the great principles that underlie all successful agricultural practice. Much that has been published on this subject is hardly worth the reading. Some time since he had occasion to study the construction and operation of plows, but could not find a single treatise that would convey to the farmer an iota of knowledge concerning the science of plowing or the rules of art that are necessary to be observed in the form and structure of this indispensable implement of tillage. In turning a furrow-slice, three distinct operations are performed, tending to the disintegration of the soil—the object of all culture. When first raised the particles of the furrows move upon each other in such a way that the furrow divides vertically as it were into thin sheets; when the slice tends still further, a similar action takes place, transversely or horizontally; and, finally, when it presses the spiral wing of the mold-board, it is similarly divided in an oblique direction, and the different ratios of motion

thus given to the particles causes them to move upon each other, and of course comminutes the soil; but how few appreciate the real philosophy of plowing the ground. The speaker illustrated his statement still further by alluding to the fact that although there are 6,000 different kinds of grasses, 126 of them in the State of New York, few farmers can distinguish more than half a dozen. Many cannot tell the difference between meadow foxtail and timothy; yet it is essential that this should be done and the difference borne in mind, because timothy has four times the nutriment for herbivorous animals that the meadow foxtail has. In order to derive any advantage from this value of one grass as compared to another, the farmer must learn to distinguish each kind. This, simple as it may appear, is no trifle. The annual grass crop of the United States is worth five hundred millions of dollars. It had been often said that he who made two blades of grass grow where one did before, was a public benefactor. Now by a careful education into the knowledge of their values, the farmer will be able to select the best varieties and do this, thus adding to the wealth of the country enough to pay the national debt. It was done, for there were farmers in New York who raised 300 tons on 100 acres, while the average over the State was only twenty-seven tons to 100 acres; and, too, in Kings county, the product was 160 tons to the 100 acres, while in the adjoining county of Queens it was only 113 to the 100. If farmers were educated to know the needs of their soil and to understand the adaptation of crops to it, we should have this result over the whole country.

De Zeng's Soluble Phospho-Silicates.

The chairman introduced Mr. De Zeng, of Geneva, N. Y., who said, it has been kindly suggested by Prof. Tillman, to bring before the attention of the Club, his soluble phospho-silicates. This article was manufactured from the slag of iron or other smelting furnaces. It was a well-khown fact, that the most fertile soil in the world was in volcanic countries; no other sections had ever produced 100 bushels of wheat to the acre. The reason of this was the peculiar creation of the soil, which was a decomposed scoria. The process has been going on for ages by the action of the atmosphere. In the production of our phospho-silicates, we merely copy this action of nature. The article is intended to be ground and mixed with other fertilizers.

Specimens were shown very much resembling pumice stone. The

matter was referred to a committee consisting of Messrs. J. B. Lyman, J. F. Whitney and Mr. Reade.

Chalk as Manure.

Mr. T. Thorn, Jacksonville, Florida, sent an envelope filled with a white powder found on his farm, and asked if it has any agricultural value.

Prof. J. A. Whitney.—It is evidently a chalky formation, a carbonate of lime; in fact, similar to several other samples that have been sent to the Club from various parts of the South. It can be used as a substitute for shell marl, or in the place of lime, but its action will be milder than either of these. In many cases this material is capable of being used to very great advantage. Chalking land has prevailed from the remotest times in some parts of England, and some districts formerly noted for their desolate barrenness have been made rich and fertile in part by this agency. The practice in these instances upon a light, sandy soil, not rich enough to grow turnips, was chalking, toning and manuring. From 100 to 150 loads, from eighty to 100 cubic yards of chalk, were applied per acre; the land then seeded to grass with barley, the barley being nourished with bone-top dressing, the grass grazed for two years by sheep, fed also with oil cake, and being consequently enriched with manure, was found after this, capable of producing a good crop of oats. This method, it will be seen, led to the gradual renovation of the land. It would, doubtless, have to be modified to suit the soil of the South, and too much should not be expected from the first experiments. The experience of practice will be needed, in addition to the teachings of theory to secure the best results.

Protecting Orchards.

Mr. S. E. Todd read a paper on the advantage of protecting fruit trees by belts or ranges of forest trees to keep off the wind, and thereby avoid the abstraction of moisture from the surface of the trunks and branches at the season when the ground is frozen, and the roots consequently unable to supply the vegetable structure with fluids. The trees being thus protected, the normal condition of the sap vessels and their contents is maintained; as a consequence, leaf, bud, flower, and fruit receive due nourishment at each stage of their growth, and the general thrift of the orchard is kept up in a high degree.

Dr. J. V. C. Smith remarked that a great mistake is commonly committed in denuding lands of their proper proportion of forest. He had been acquainted with a gentleman who had followed the plan mentioned by Mr. Todd and met with very great success.

Mr. A. S. Fuller took exception to Mr. Todd's views. The universal protection advocated by the latter would be simply universal destruction. If fruit trees were sheltered in this manner they would leaf out, bloom early, and be cut off by frost. He had wished a hundred times that the cold winds could sweep over his own trees and keep them back until the danger of frost was past.

Dr. Isaac P. Trimble agreed with the last speaker. It is well known that winds are not as cold as dead-still air.

THE HEAVIEST STEER EVER KILLED.

Mr. Clarkson Taber, New York city.—I notice that a correspondent calls for the heaviest beef ever killed. Reunion, sent here in 1866, and fattened by T. H. Tripp, of Dutchess county, weighed 3,795 pounds, lacking five pounds of 3,800, and dressed 2,475 pounds. I have been nine years in the live stock market, and I never knew a larger animal, and there is no tradition of a heavier one among our New York cattle dealers.

GRAPES.

Mr. J. H. Woodburn, Kingsville, N. Y., has a somewhat extensive assortment of grapes, which have been in bearing for from one to three years. Among the varieties a Herbemont, Lincoln, and Lenoir. Now, whereas there ought, according to catalogue, to be a difference of some weeks in the ripening of these three. Last season they ripened at the same time, the clusters were of same form and size, color and taste, and resembled in all respects the wild frost grapes, much to the owner's chagrin, and he would know the why and the wherefore; "and are these sorts considered valuable; and are grapes ever known to be affected in color, size, quality, or time of ripening by standing close to other varieties; and do they ever mix as do corn and many other things?"

Mr. A. S. Fuller.—The varieties named all belong to the same class, and this fruit are of similar size and color, and if all were imperfectly ripened it would be difficult to tell one from the other. There is however considerable difference in the shape of the leaves and in the time of ripening, but I fear that the gentleman has been imposed

upon in the purchase of his vines, having procured only one variety under three distinct names. These grapes do well in some of the middle and some of the southern States, but are of little value at the north. Grapes do not mix and become intermingled like corn when grown side by side.

Currants and Cranberries.

Mr. George Partise, Reed's Corner, New York, asked if black currants can be grown with profit, and are they cultivated in France for wine purposes, and what sort of mixture do they make?

Mr. A. S. Fuller.—Yes; black, like almost any other variety of currants, can be produced with profit. Black currants are grown for wine in France and in England, and other countries as well, but they make a vile decoction which some people take to as others to New England rum.

Mr. R. Johnson, Milford, Delaware, has an acre and a half of good high land, and desired to know if it will pay to plant it in red Dutch currants; second, "a freshet two years ago broke our mill-dam and washed large quantities of sand (the action of the water removed the alluvial) on the bog below. We have since cut off the wood and brush, and I think I could, by a small outlay of money, make an acre and a half of good cranberry land. The only trouble would be the large tussocks standing every four or five feet, which could not be removed without great expense. Could I let these remain with a reasonable prospect of success? The sand in some parts is a foot deep, but grows clover luxuriantly. Is it too deep for cranberries? What will the plants cost per acre?"

Mr. A. S. Fuller.—Currants, as a general thing, do not do well in a warm climate. In southern Delaware it would require good care. A heavy soil, well covered with mulch in summer, or the fruit and plants would be likely to suffer from heat. The bogs covered with sand will do for cranberries; but, from description I should think there would be considerable trouble in keeping down weeds. For successful culture, the soil should be covered with sand of so poor a quality that no weeds will grow upon it for the first season at least, and by the second the cranberry plants will get a start sufficient to smother any that may start. The tussocks mentioned ought to be removed. The plants can be purchased from three dollars to four dollars per thousand.

Brick and Tile Machine.

Mr. Thos. J. Cornell exhibited a brick and spoke of a new brick and tile machine which had taken the prize at the Institute fair.

Mr. J. B. Lyman asked the price of the machine, and stated that if a machine could be gotten up at $600 there would be a large sale for it at the west for making drainage tiles.

Mr. T. J. Cornell stated the price of their machine is $1,500, but thought arrangements might be made to afford it at less.

Adjourned.

April 19, 187 .

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Rocks in Fields.

Mr. E. N. Dwyer, North Bennington, Vt.—I have in my field a great number of boulder rocks, and would be glad if the Club could tell me some cheap and easy mode of getting rid of them. They are very hard, so that the best drill makes but little impression. Would gun-cotton be better than powder?

Mr. R. J. Dodge.—I have heard of nitro-glycerine being used in similar cases.

The Chairman.—This substance has been used with great effect in the East river. For some reason its use has been discontinued, but, I have heard it is to be resumed. It is a very powerful and effectual explosive material.

Dr. Isaac P. Trimble.—The old-fashioned way to get rid of boulders was to build a fire around them, and, when sufficiently heated, pour water on them, and they would crumble to pieces. Nitro-glycerine was a dangerous stuff to handle, and he would not advise any farmer to use it.

Mr. H. L. Reade.—I would like to know what is the theory of blasting rocks under water; whether the immense weight of water forced the power of the blast against the rock.

Chairman.—I suppose such is the theory, as in the Hell Gate operations they merely laid the explosive material on the rock.

Feeding Cattle Green Corn Fodder.

The same correspondent said: I feed my cattle green corn stalks and fodder, and they eat them one or two days, and then nothing

will induce them to touch the green stuff. I have regularly sowed corn for its green fodder for a number of years, but when I feed to the milk cows in July, they will only eat one day and then leave it for a scanty pasture. They will do a little better when sweet corn is sown.

Mr. A. S. Fuller.—I tried the sweet corn, and my experience is the same. If positively starved to it, cows will eat it. My horses ate one mess and then stopped, and would not touch it again as long as they could get anything else.

Mr. D. B. Bruen.—A neighbor of mine, near Newark, sowed one piece of ground and cut it just as it was about to silk, let it wilt a day or two, and then fed it. He thought that in summer his cattle could not do without it.

Mr. A. S. Fuller.—If wilted, the cattle will eat it better.

Mr. H. L. Reade.—I have practiced this feeding for years. I plant sweet corn, and always cut a day's feed ahead. My cattle never refuse to eat it. In a conversation with Mr. Putnam, one of the best farmers in Connecticut, a few days since, I was informed that he adopted the same system, and never had any trouble.

Raising Swine.

Mr. W. McEvoy, Equality, Ill.—I desire to raise and fatten as many hogs as my means will permit, and, to do so to the best advantage, would respectfully ask answers to the following questions: 1. Would boiling water thrown on corn meal cook it sufficiently? 2. Is there anything to be gained by feeding corn and cob meal? 3. What is the value of rye, barley, and oats ground, as compared with corn meal? also, wheat bran, turnips and potatoes cooked?

I would like to know of a simple and effective remedy for destroying vermin on swine. Every farmer should know it, and the lice should be made to understand it too.

Mr. F. D. Curtis.—The breed is a matter of much importance. Out there he can get Polands, which have a great name. But the Chester is a great favorite, and in New Jersey, where they raise the biggest, often reaching an average of 500 pounds through a lot of two score, they have a copper-colored hog that takes on flesh wonderfully. For a big porker you must have a good frame, and this should be built up during the Summer on a good grass range before corn is hard. Farmers often miss it here. They don't give their hogs a chance to *grow* before they begin to stuff with corn. I like to see a

hog have a good range during the summer, and if fed, let it be with oat meal or wheat shorts in sour milk. Then as soon as corn is hard the fattening begins. The question of cooking for hogs is one that each farmer must cipher out for himself. It depends on circumstances.

This Illinois farmer must tell us the full price of corn, of potatoes, and also of coal or wood, and labor. Three bushels cooked go as far as four fed raw. He saves a bushel. But in saving that bushel, how much time does he consume, how much fuel, and *whose* time? If he has a lad or an old man on the place that can't make a full hand in the field, but can do chores as well as a full hand, *that* must be considered. The same remark applies to the cob. There is some nutrition in it, but how much will it cost him to get that nutrition out? Every farmer must settle a great many such questions for himself. What is thrift for Warren Leland, on his farm twenty-five miles from New-York, may be unthrift on a farm 2,500 miles from New York, and any saying in this Club must be taken with the salt of due allowance.

GRUBS.

Mr. D. M. Fisher, Perch Spring.—Last Summer they destroyed millions of bushels of corn, wheat, rye, oats and potatoes, and from present appearances they threaten to be as plenty this season. The weather is open, and we are plowing sod in an orchard. Part has trees and part has not. Wherever there are trees we find but few, but where there are none they can be counted by thousands. Now can any member of the Club say why this is the case, or do you know of any remedy to kill them. Fall or winter planting will not answer; I once tried this, and they eat all of my corn.

Mr. F. D. Curtis.—If I had such a piece of ground I think I should summer fallow it, or, what is pretty much the same thing, make a hog and hen pasture of it, and plow it twice. Perhaps I should scatter a peck or two of corn, some on the furrow and some under, to bait the hogs, and get them in a way of industrious rooting.

The hogs will clean them out if they once get in the way of rooting for them, and the hens will help.

BIRDS—BLUE JAY AND WOODPECKER.

Mr. Charles Carlisle, Woodstock, Vt.—Small fruit men think it pays to feed and befriend the blue jays; they mimic and mock other birds' talk, scare and deceive with a screech like a hawk. I have

been cultivating small fruits a number of years past; I soon learned that my interest and the interest of the blue jays were reciprocal. I allow them free access to my corn crib in the winter; in the summer they provide for themselves, and act the part of a police force to protect my crops.

Mr. Ira Brewer, Binghamton, N. Y.—In my opinion the woodpecker is one of the most useful of birds; but, strange to say, he has become entirely extinct in this region. Not a solitary bird of this species has been seen here for years. They have been the sure mark of the wanton sportsman; the result is that the borer is destroying our apple and other fruit trees by the thousand. His natural instinct taught him where to find the worm with unerring certainty. His loss is equivalent to half the loss of our apple crop.

The Chairman.—Dr. Trimble has often told us of the great value of the woodpecker, and I am pleased to see this indorsement of his views.

Dr. Isaac P. Trimble.—There are several varieties of woodpecker. That I consider most valuable is called the Donny woodpecker. I believe it to be the most valuable bird in the country. He was always after the apple worm; yet one of our agricultural papers has published an article, advising them to be killed wherever found. It showed a lamentable ignorance.

Mr. F. D. Curtis.—Sitting at my window a few days since, I saw two woodpeckers near my bee-house. Careful observation convinced me that they were looking for moths and ants. They did not disturb the bees. A great many farmers were so unwise as to think they ate the bees.

Dr. J. V. C. Smith.—Some of the Club may recollect that last winter I had dissected in your presence a bird of this species, and showed how, by the intensely fine sense of hearing, he is enabled to detect the worm or insect underneath the bark, and then by his strong bill to dig into the recess, and by the peculiar formation of his long tongue, to thrust it in and twist the worm out. His was really a wonderful structure. While the forests existed they had a home and a hiding place, but as civilization advanced they fled before it. I think they cannot be too much encouraged, and hope some means may be adopted for their increase.

Production of Corn.

Mr. J. Disturnell read a carefully prepared and able paper on the production of corn. Of this article the western and southern States

produce the greatest quantity, and of these Illinois stands first. Of the southern States, Virginia produces the largest amount. Of all the States, the smallest amount is produced in New England. This staple is chiefly consumed by cattle and hogs, and thus goes to increase the material wealth of the country, beef and pork forming the principal products of export from the western States to the eastern and southern States, and foreign markets. Chicago, Cincinnati, and St. Louis are the great marts for beef and pork, as well as Indian corn, all of which interests require greater facilities for transhipment to the seaboard, where are found consumers and purchasers. In intrinsic value corn may be said to exceed or at least compare favorably with wheat, cotton, or hay. As an article of export no agricultural product can compare with cotton, yet during the war the exportations of the grain crop were very large. The number of cattle in the United States in 1860 was 25,616,019, being about eighty to every 100 inhabitants. The number of hogs was 33,512,867, or more than one hog for every inhabitant in the States and territories. The distribution of these animals will be found to agree in their native State very nearly with the product of corn, which is their principal food, if we except grass, which is alike the food of horses and cattle. Grass and hay form another very interesting subject of inquiry, as to where it is raised and where it is consumed. Grass is greatly influenced, both in quantity and quality, by climate influences, growing in the greatest perfection along the center of the temperate zone, where there is a mean annual temperature of fifty degrees Fahrenheit; the grass, or butter zone, as it may be called, lying between an annual temperature of from forty-seven degrees to fifty-three degrees Fahrenheit—thus running around the world. The southern limit of the United States, commencing in southern New Jersey, *cutting* Delaware, Maryland, including the valley of Shenandoah in Virginia, West Virginia, Ohio, Indiana, Illinois (near Alton), northern Missouri and Kansas, until, owing to the elevation of the Rocky Mountains, it ceases to be raised in abundance. The northern limit may be said to be parallel with the growth of wheat, which is produced in abundance where a summer temperature of sixty degrees Fahrenheit, including the northern part of the United States and Upper Canada. So far as our European market is concerned the exports of our agricultural products are substantially limited to the articles of wheat, wheat flour, Indian corn and meal, and beef and pork, comparing favorably with cotton and tobacco. The above great products are principally shipped to

Great Britain, France, Spain, Portugal, Belgium, Holland, Denmark, Bremen, Hamburg, and Italy. These manufacturing countries of Europe are those from which the United States import most of their foreign manufactures and luxuries for consumption, leaving a balance of trade in their favor, which state of trade should be reversed in order to make our country prosperous and happy.

DRAINAGE.

Mr. Thomas Johnson Perry, Ohio.—I have a farm of 120 acres, formerly covered with timber, and much of it under water half the year. I have cut off the timber with my own hands. I have also made 1,200 rods of open ditches, in depth from two to three and one-half feet, and from eight to twelve feet wide at top. I use a plow and scraper, taking the earth into the field, filling up all low places. I have underdrained with brush; that did no good—the crabs shut it up. I then tried timber, laying a rail at each side of my ditch, then covering with oak-heading two feet long and two inches thick, laid crosswise. This answers a very good purpose as long as it will last —about twenty years in drains that are dry half the time; when there is water all the time it would last longer. I am now using tile from two to five inches inside of the pipe. I am putting them down from two to five feet deep. At the bottom of my drain I cut a groove the size of my tile. I then commence at the upper end of my drain to lay tile, pressing them down into the groove. I choose a time when there is water in the ground. I put a good hard brick at the end of the first tile, pressing each one down until the water will pass through, clearing out all loose earth that may fall in with a tool made for that purpose. My experience is that land that is not worth five dollars per acre for farming purposes without being drained, is worth sixty dollars after having been thoroughly drained. It will cost about twenty dollars per acre to drain land here. We pay $1.25 per 100 feet for two-inch tile, $2.10 for three-inch, three dollars for four inch, four dollars for five-inch, $4.50 for six inch. I have raised 120 bushels (ears), of good sound corn per acre, twenty-seven bushels of wheat, sixty bushels of oats, and this on land which would not do anything without drainage.

CURRANTS.

Mr. A. S. Fuller distributed some cuttings of the large cherry currant, and said: The best time to make cherry cuttings is in the autumn, soon after the leaves fall. I cut the stems into sections six

inches long, and plant so deep that only one or two inches will remain above ground. At the approach of cold weather cover with straw or hay four inches deep; next spring remove the covering. Although the fall is the best time to plant the cuttings, yet spring will do, and no one should neglect planting a few cuttings, even if the leaves have started.

The Chairman.—I do not like the standard varieties; they look well and give large fruit, but soon give out. I prefer the low clump bush.

ACTION OF MUCK IN THE COMPOST HEAP.

Prof. J. A. Whitney read the following paper: The uses of muck in the compost heap are fourfold; to absorb mechanically liquids that would otherwise be lost; to retain chemically gases that without it would be wasted; to bring the various manurial substances into that condition in which they are best adapted to the needs of plants, and to make them of easier application to the land. In the management of muck we must keep all of these in view, for the failure to do this has caused most of the disappointment that in many cases has been experienced with experimental compost heaps. To be a good absorbent the muck must be neither rotted to the condition of loam nor undecomposed enough for fuel, and it must be well dried. These requisites being provided, the muck must be stored where it can be used, a part at a time, when needed, and the compost heap must be located in a position to receive the manurial substance with no more than their natural dilution. If a stable is so constructed that the liquids will flow readily to a manure cellar underneath, the muck may be spread in a layer on the floor of the cellar, and the solid, as well as the liquid manure, may be thrown upon or conducted to it. A little gypsum should be sprinkled over the mass occasionally, and as soon as a surplus of liquid, or any emanation of ammonia is noticed, the whole should be leveled off and a thin layer of muck provided, and the addition of manure repeated. When the cellar is protected from frost this practice will give very good results with as little trouble as any mode of composting, but the compost will require much shoveling over when taken out of the cellar in order to secure any kind of uniformity in its character. Furthermore, the moisture steaming from it during fermentation will prematurely rot the timbers of the floor above. There is also very frequently the further consideration that such cellars can be more profitably used for storing

roots, potatoes and the like, or as shelter for pigs, calves, etc. Upon the whole, a different procedure, involving somewhat more of labor, but giving a manure of more homogeneous character, is preferable. Such a method will be found in what may be termed a modification of the earth closet system, a portion of the absorbent being supplied just at the place where it is required, and mingled at once with whatever liquid or solid is dropped upon it. For such purpose the muck should be stored in an out-house close to the stable door, and each morning when the stables are cleaned the rear portion of the floor should be covered half an inch deep with the dry material. Over this the wet and soiled litter may be thrown to keep the muck from being dusted about by the feet of the animals. Saturated with liquids in the course of the day, it should be shoveled over at night with the more solid droppings, and the whole thrown into a covered shed outside, where it will ferment and undergo those changes which render it more immediately available when mingled with the soil. It has frequently been suggested—and sometimes put in practice—to allow the liquid manure to run into a tank, and afterward pump it upon the manure heap. Even where this is done the use of muck is advisable, because the dry vegetable substance will possess greater power of absorption than the moist excreta even of horses or sheep, which is dryer than that of most other farm animals, and because, as there will presently be occasion to mention, the decomposition of the muck will evolve a greater quantity of the organic acids which, in the fermentation of stable manure, play a most important part in the fixation of its valuable constituents.

The farmer will perceive that the prime object, in the present connection, is to secure the greatest saturation of the muck by the liquid portion of manure. To insure this he may use either of the methods above mentioned, or any other that his ingenuity may devise. The prime truth to be kept in mind is that, aside from the components of the muck itself, of themselves comparatively unimportant, the compost is worth just what is put into it and no more. We mingle with it the solid manure as a matter of convenience, but the great value of using muck in stable practice is the saving of the liquid manure, which by any other treatment would, in whole or in part, be lost. The value of this saving may be estimated when we consider that although the quantity of water in the urine, say of the horse, is in excess of that in the dung in the proportion of eighty-five and one-half to seventy-seven and one-quarter, yet a portion of the solid matter

of the dung is carbon, and of little value as plant nutriment, whereas the solid matter of urine is wholly made up of mineral and nitrogenized substances that enter directly into the structure of vegetation. The dung and the urine together contain all the enriching materials which the vegetable food of the animals originally derived from the earth, and which it is the office of the farmer to restore to it for the growth of future crops. But the dung contains one portion of these enriching materials, and the liquid manure another and very different substance. Hence, if we waste the latter, the balance or proportion in the different kinds of plant food required for thrifty growth will be destroyed. It is a maxim of agricultural chemistry that all of the essential elements of plants must be present in due quantities, not one must be absent or diminished; for if it is the power of the plant to absorb and assimilate, the others will be reduced in a corresponding ratio. From this it is evident that by wasting the liquids we not only lose just so much of the elements of fertility necessary in the soil, but we impair the capacity of the solid manure to give its full effect. In other words, a perfect manure is simply an animal manure, which includes the natural proportions of both solid and liquid excrement. By the ordinary practice the liquid is mostly lost; it is the province of muck to save it. Nothing comes from nothing. The manure is the food taken in another form from the ground, and which must be returned to it if its fertility is maintained. The undigested or unmasticated part of the food passes from the animal in a more or less solid form. That which is digested passes into the system, undergoes its round of duty in the animal organization, and, being filtered through the kidneys, is thrown out in a solution. The dung is rich in soluble silica, in potash and phosphoric acid, and also in lime, soda, magnesia, sulphuric acid and the like; the urine contains alkaline salts of various kinds, but is especially rich in a substance termed *urea*, capable of evolving ammonia when decomposed, and from which the greater part of the manurial value of the liquid is derived. This is so marked that Boussingault states the amount of ammonia in the urine of a horse as three times that of the dung, and that of the cow as twice as much. The value of muck in absorbing and retaining the liquid is therefore very great, and, in reality, by this saving, enables the farmer to double the quantity of plant food or true manure from his stables, as compared with that obtained by the usual slovenly practice. No definite rule can be laid down concerning the proportion

of muck to that of manure in the compost. This will vary with the character of the muck. As much is needed as will absorb and hold the liquid and no more. In general from forty to fifty per cent of the entire mass may consist of muck.

The first requisite of a properly managed compost pile, the thorough saturation of the muck with the liquid manure, having been secured, we may turn for a moment to the nature of the chemical changes that occur in the mass and the agency of the muck in the utilization of the substances mingled with it. We have thus far considered it simply as an absorbent, holding liquids like a sponge. We may now view it as a means of preserving gases, in which its mode of action will be somewhat different.

It should be kept in mind that the most active ingredient of manure, ammonia, does not exist ready formed either in fresh dung or in fresh urine, but is produced by the subsequent decomposition of certain nitrogenized compounds contained therein. This accounts for the slow action of fresh manure in the soil as compared with that which is well rotted. Supposing our compost to be newly made of mingled muck, liquid and solid manure, the reaction is substantially the same as occurs in a fermenting dung heap, except that, theoretically, at least, the waste of gases will be less and the changes more sharply defined. Horse manure, it should be mentioned, should form some portion of the heap whenever possible, as that of cows, pigs, &c., notwithstanding the highly ammoniated nature of the urine mixed with it in the heap, is too cold to produce decomposition as quickly as is desirable.

Being moist, and more or less permeated with air, decomposition of the more complex particles of organic matter occurs as the first step in the reduction of the compost to its most efficient condition as a fertilizer. This, of course, produces heat, which hastens decay in the rest of the mass. The decomposition of the urea and other nitrogenized bodies evolves ammonia, which, as we all know, is alkaline in its nature. Simultaneous with this the decomposition of the muck also progresses, and gives rise to ulmic and analagous acids. These last unite with the ammonia to form ulmates, &c. *These salts of ammonia are not volatile, and consequently do not fly off into the atmosphere, as ammonia alone will do.* Just here a note may be properly made concerning a query often made as to the propriety of mixing lime with manure in the process of composting. This is too often done. The mixture of lime with fresh manure will

not drive the ammonia therefrom, because as just indicated, there is very little in it. As soon, however, as decomposition sets in, evolving ammonia from the nitrogenized matter, and producing organic acids from the woody or carbonaceous substance of the manure, or of the muck, as the case may be, the lime unites with the acids and usurps the place of the ammonia, so that the latter passes into the air and is lost. From this has come the common sense precept, "never mix lime with nitrogenized manures of any kind." With regard to the sulphate of lime or gypsum, however, it is very different. This substance has the power, not quite understood and never fully explained even by the oldest and best chemists, of fixing or retaining ammonia. For this reason it may be used to advantage in the compost to help as far as may be the decomposing muck to collect and retain the ammonia as fast as generated. Yet it must not be supposed that the retention of the ammonia is wholly due to the organic acids above mentioned, for this is not the case. The muck particles possess a very great power of mechanically absorbing ammonia, when wet frequently as much as two per cent, and of this when dried at ordinary temperature it retains from one-half to three-fourths. Neither must it be supposed that the acids of the decaying peat have no other function than to unite with the ammonia. A portion of these acids unite with the other alkalies, soda, potash and lime, liberated from their original combinations in the manure. These several ultimates of ammonia, potash, etc., all have a dark brown color. This may be kept in mind by the farmer who allows the rain to saturate his dung-heap, and run thence in a chestnut colored stream to the nearest ravine.

At the outset of this article it was remarked that one of the objects of composting is to bring the various components of manure into that condition in which they will prove the most beneficial to vegetation.

This is secured, firstly by the retention and utilization of both the liquid and solid elements of the manure; and secondly, by the conversion of the nitrogenized components of the latter into ammonia, either combined with organic acids or held mechanically absorbed in the muck itself, but in either case readily assimilable by the roots of plants as soon as mingled with the mold and subjected to the action of the chemical agencies at work in the soil and the vital functions of vegetation. A manure made and managed in this way will come the nearest of any to a truly universal manure, inasmuch as all the elements of the plants eaten by the animal are contained in it in the very form best adapted, when mingled with the soil, to enter into a composition

of the same plants again. As different varieties of vegetation call for different proportions of the elements of plant nutrition the nature of the compost may, when desired, be modified to meet the exact requirements of each case. The same remark will apply to crops at different stages of their growth, but this involves, in practice, the addition to the heap of substances other than stable manure, such as animal offal (the very best material for the purpose when it can be obtained), guano, night soil, bone dust, phosphates and the like, for further mention of which there is not room within the limits of the present sketch. The more easy transport of the liquid manure consequent on its mixture with the muck is of much practical importance, but need not be enlarged upon, as the convenience of handling and distributing with a shovel, as compared with the use of barrels, wheeled tank, and sprinklers, is very evident.

Adjourned.

April 26, 1870.

Nathan C. Ely, Esq., in the chair; Mr. John W. Chambers, Secretary.

Country Homes for City Boys.

At a previous meeting the subject of finding places on farms for such children of the streets as may wish, or whose parents may desire to change their base, was considered, and a committee, consisting of Messrs. Frank D. Curtis, Chairman; J. B. Lyman and H. L. Reade, was appointed to look into the matter. Having done so, they submitted the following report, which was adopted:

Many denizens of the town look with longing eyes to the waving fields of the husbandman and the home laden with plenty. To them it doubtless seems that the happy farmer has nothing else to do but to enjoy the fruits of the earth in their season, and bask in the sunshine of rural felicity. To all such, who know nothing of the practical experiences of a farmer's life—and no life has more of the practical—agriculture would not be a success, and, not being a success, would consequently abound in perplexities, disappointments, and lead eventually to disgust. "A love of nature," however ardent, could not counterbalance these evils. Farming, to be fully enjoyed, must be understood. A novice who is willing to put himself under tuition, could reap the enjoyment of an education and its ultimate benefits. Conceit is no handmaid to the farmer. The hands must

be ungloved and made hard with manly toil; weary limbs, a sunbrowned face, a homely garb, long hours, a patient waiting for the harvest, and modest gains, are what the farmer is and has before him. With ordinary care and industry he is sure of a comfortable living, according to the standard of comfort in the country. Luxuries—excepting healthful food, pure air, vigorous blood, and nature's realm, are accounted luxuries—he does not have. How much these things are worth to a person depends on his tastes and inclinations. With some they would be valuable; with others not to be exchanged for the privileges, glare and gloss of city life. The latter had better remain in the town. To the young man or boy who has a natural taste and love for the country, we would say, by all means go. If you want to be a farmer and do as farmers do, go bare-handed, wear every-day clothes and work, you will succeed. Do not expect too much. You cannot master the trade in a month or a year; but you can learn enough in a short time to begin, and then keep on learning all your life. It is the willingness to learn which is half the battle. The question addressed to the Farmer's Club is, "How shall we learn?" With a practical farmer, one who does his own work, with such a man the youthful learner will be a social equal; he will not live in as fine a house or have as fine grounds as the gentleman farmer. The former will not dress so well; his daughters will play upon the wash-board and sing to the tune of the churn-dash, but here is knowledge, and "knowledge is power." There will be time to read. The long winter evenings can be turned to good account. As a quaint old farmer used to say, the man gets rich who says "come boys," and not "go boys." This is the sort of farmer for the city boy to attach himself to. The other question is, "Where shall we go?" More labor is needed everywhere in the country. Your committee would, therefore, recommend that practical farmers who are willing to employ boys and young men from the city who are out of employment and desire to learn farming, be requested to address the chairman of the committee, at the Metropolitan hotel, New York city, and that the boys and young men send in their names, ages, &c., so that an exchange of wants may be had and places provided. In this way an exchange of information can be established, of mutual benefit and of great value. The committee would further suggest that no person apply to go to the country unless he be thoroughly in earnest, and that no farmer offer to take an applicant unless he has made up his mind to be patient and painstaking

in his instructions. A boy must be something more than a drudge. The home must be made pleasant and the labor lightened with good cheer, variety, and the sunshine of gratified ambition.

Sumac.

Mr. L. Casson, Alexandria, La., would know the characteristics of the variety useful in tanning.

Mr. J. B. Lyman.—It seldom attains a height of over twelve or fifteen feet; grows on rocky soils in the northern States, though it does not require such habitat. It splits easily; has a pith that is easily removed; the sap wood is white, but nearer the heart is of a peculiar greenish yellow, and emits for a long time after being cut a sweetish and rather pleasant odor. It has cone-like bunches of berries or seeds, that are covered with a scarlet down. These remain on the stem long after frost, and have the effect of a scarlet flower. The wood is much used for sap spouts, as by removing the pith a good tube is obtained. Its commercial value is in the tannic acid which the leaves and stems contain; and there is much more of this in July, or in a hot country, than when it is cool.

Cutting Potatoes for Planting.

Mr. F. Gleason, Schenevus, Ostego county, N. Y.—I have been testing the relative merits of cutting potatoes and planting whole. I have planted some that were cut several days before planting, some cut the day of planting, and planted some whole. Those which were cut several days before were the poorest; those planted whole were the best. They yielded, for the same number of hills, about one-third more than those cut days before planting; those from seed cut on the day of planting, about half way between the first and the whole potato.

Mr. Adrian Bergen.—I have studied the subject of cutting potatoes. Potatoes have a number of eyes; every eye will produce a sprout. If we plant the whole potato we have too many vines. I prefer to cut them in two or three pieces, and then, if any of the pieces have more than one eye, I cut all out but one. I think it is a disadvantage to cut the potatoes a day or two in advance of planting; in fact, I think it would be somewhat of an injury.

Mr. H. L. Reade.—I have cultivated potatoes for about fifteen years, and have been reasonably successful. When we dig our potatoes, we sort them into three piles; largest for market, next for home

use, and the smallest for planting. I cut the potato into two pieces and plant them in a hill about two inches apart, and I may say I always have a good yield. I tried the experiment of the whole potato, and cannot say that it had any advantage over my system. I separate the two pieces in the hill so as not to have the vines too close together, as well as giving more soil for nourishment.

Dr. J. V. C. Smith.—I do not agree with what I have heard said. It is my notion that the vine thrives best with a whole seed, as the starch, &c., of the potato seed in its decay will serve to feed the plant. Hence, I approve of the whole seed. Since the question had been agitated by the Club, I have been told that some farmers find that the apple tree grows best if planted in the pumice from the cider press, or in the whole apple. Nature, in all her works, had decreed when the young life came into existence, that there should come with it a sustenance peculiarly fit for its nurture.

Mr. Horace Greeley.—The analogy was not perfect. The bean and the apple seed were strictly seeds. The potato was a combination of seeds, every sprout was a seed, and the seed only was to have a sprout, be the piece that sprout was on large or small. The potato might be said to carry its seed on its surface. The bulk of evidence on this matter determines that a piece of potato weighing one ounce was as good as a half a pound if it have the sprout on it.

Dr. R. T. Halleck.—I once planted parallel rows. One containing small potatoes whole, the next cut potatoes, the next large whole potatoes. When I dug them I could see no difference in crop of cut and large whole ones, while there was a sensible diminution in the row of small. I am inclined to think there may be some advantage from the distribution of the potato over the greater soil surface, but perhaps counterbalanced by greater amount of vines. I ean see no advantage in cutting three or four days before planting.

Mr. J. W. Gregory.—In 1865, I tried an experiment with one potato. I cut it into fourteen pieces. I put each piece into a hot bed. After one month most of them had sprouted. I drew them out, took off the sprout, and transplanted them, and then put the potato back. After a time repeated the operation. In this way I got thirty-eight plants. They yielded a half bushel and over half a peck for this one small potato. Mr. Greeley was correct; the potato was a tuber and not a seed; the plant was a continuation from a tuber, and might be renewed as long as the tuber lasted.

Mr. A. S. Fuller.—There is no doubt that in the last year there

has been more testing with small amount of seed then ever before, because so many farmers have tried the new and costly varieties of potatoes in a small way. I have over 1,000 letters from farmers speaking of these tests, and stating their results. They state their yield from one potato at from forty to 100 pounds, and one says 120 pounds from the pound of seed planted. These facts proved that farmers had heretofore planted too much seed. The only point between large and small potatoes was that the large has more eyes; and, too, I think it is a good deal like choosing vines. If one wants a good vine, he takes a cutting from a strong, healthy stock. I think the half ounce as good as a pound, but in getting the half ounce seed prefer to take it from a large potato, not so much, however, amount of material, but quality.

Mr. Adrian Bergen.—I would plant the large potato, but cut them, and would cut them as I am ready to plant.

Mr. Horace Greeley.—It is a rule in almost all plants that small begets small, and large large. The reason of this was that the small potato was usually formed late in the season and did not get its full growth, was not perfectly ripened.

Mr. F. D. Curtis.—The potato grows from a sprout; the roots strike out from the sprout, and if you take away the sprout and transplant it, it will continue to grow; the potato will sprout again, and you may thus get ten or fifteen sprouts from a half ounce of seed. Small potatoes had a small eye, and gave forth a small, delicate plant. The large gave just the opposite. A good deal of bad planting and too many settings were the cause of bad crops. The greater number of settings in a hill, the smaller the potatoes. Most farmers cut the potato to make the seed go further. I can see no reason for cutting two or three days before planting, unless the idea that some of the nutriment escapes when fresh cut, and that it is best to heal over. Small potatoes were no doubt sometimes caused by a not sufficient growth.

Mr. Addison Oliver, Onawa, Iowa, has seen no potato yield equal to his, of which he incloses the subjoined statistics: "Last spring I planted one pound of Early Rose, cutting to one eye, and planting in forty-three hills. They received no cultivation but two hoeings. I dug about September 20, and after being washed clean, the crop weighed 340 pounds, or five and two-thirds bushels. The largest potato weighed forty-four and one-half ounces. Several weighed two and one-half pounds each. We have plenty of land here which

will raise as good potatoes at from two dollars to ten dollars per acre.

Sorghum Fodder.

Mr. R. Lewis, Cuba, N. Y., writes: Will sorghum stalk and fodder answer for feed to stock, and where can I get good seed?

Mr. Horace Greeley.—I have planted the sorghum for its fodder, and am well satisfied of its value. It will grow more as feed than corn, and is more nourishing. But at Cuba the frosts come too soon for it to be of any value. It comes too late in this climate. At the south, in the Carolinas and Georgia, I have no doubt it would be of great value.

Mr. F. D. Curtis.—My experience is the same. I have had a yield of forty tons from the acre, but, as Mr. Greeley remarks, it comes too late in this climate. My cattle ate it and liked it.

Mr. H. L. Reade.—Could it not be used for fodder?

Mr. Horace Greeley.—No; it dries to a crisp.

Prof. H. E. Colton.—I have a friend in the south, a large planter, who used it years ago, and was much pleased with it as a green food; preferred it to anything else he could get. Its use became very general until during the first year of the war some cattle were poisoned by eating it, in Guilford county, N. C. This gave it a bad name for a while, but that soon passed away. I investigated the matter, and found that the fodder and stalks which the cattle ate had been cut for several days, and when fed were wet with dew. I imagine some new form of acid was created by a union of the fermented acid of the plant and the dew. No other bad results were ever heard of, and it is very generally sown, as corn is here, as a green food for stock.

Club Foot in Cabbage—Effects of Marl.

Mr. B. Bishop, New Russia, N. Y., writes: When I was a boy I had the care of my father's kitchen garden, which was on old ground, where it was almost impossible to raise a single good head of cabbage on account of the club foot. I experimented until I found a remedy that I have never known to fail in a single instance. Fill a kettle with the leaves and twigs of red-berried elder, sometimes called stinking elder. It can be distinguished from the common sweet elder by its blossoming much earlier in the spring, and by its scarlet berries; also by its brown pith. Add water, and boil till you get a strong decoction; when it is cool, pour carefully on the center of each plant

about a gill. One application is generally enough. On tenacious soil it might be necessary to loosen the earth around the stem of each plant a little. As a preventive, all that is necessary is to water the plants with the decoction once or twice after they are set out. It also acts as an excellent liquid manure, as any one can see by the vigorous dark green the plants assume after the application. It is better to boil the elder in the open air, as it emits a villainous smell. My brother had a whole patch so badly affected by the club foot that the outside leaves turned yellow and the plants would wilt in the heat of the day. One application saved them, and they produced as fine heads as you would wish to see.

Dr. Isaac P. Trimble stated that the committee on marl had some letters which would answer this letter:

C. S. Macknet, Newark, N. J., writes: I received over a bushel of marl as an experiment on cabbage. I set out about 100 plants; to about one-third of them I put a handful of marl, the other two-thirds I did not put anything, and the two-thirds were nearly all club footed—good for nothing; the one-third that I marled grew very large, no club foot about them; the only drawback was they grew so fast that they did not all head hard, but were much better than those that had no marl, although the hard heading might not happen another year.

Mr. Stephen H. Young, Boonton, N. J., writes: In regard to the effects of marl, I received nearly a ton from Mr. Paul, in Newark. It was late in the season to apply it in the hills of either corn or potatoes—both had been planted. But when they were up I applied as much as I could hold in both hands around the hills, and hoed in. The effect upon both was very manifest, and especially upon the corn. Many of my neighbors were so amazed at the rank growth as to be very anxious to know what had been used. I raised cabbages in great quantities. My last crop was planted on a clover sod, highly manured broadcast. I also applied manure in the hills of all but two rows, and in these I put a double handful of marl. The growth of the cabbage in these two rows, from the beginning till the heads were matured, was much greater and more rapid than the others, the heads large and heavy, and were the best of the whole crop. Another thing, there was not a club foot in the whole of them. I shall certainly use marl freely in the future, if I can get it at anything like reasonable terms, as I found out the value of it.

AN ACRE—A VALUABLE TABLE.

The Chairman read from a slip forwarded by a correspondent the following measurements, which indicate the area of an acre of land:

Five yards wide by 968 yards long; 10 yards wide by 484 yards long; 20 yards wide by 242 yards long; 40 yards wide by 121 yards long; 80 yards wide by 60½ yards long; 70 yards wide by 60⅑ yards long: 229 feet wide by 198 feet long; 440 feet wide by 99 feet long; 110 feet wide by 369 feet long; 60 feet wide by 726 feet long; 120 feet wide by 363 feet long; 240 feet wide by 181½ feet long.

FENCE POSTS.

Mr. B. Roberts, East Varick, N. Y.—Please post me in the matter of fence-posts. Will coal-tar preserve them? Will salt pickle them? Will blacksmiths' cinders save them? Can you assure me of any plan that will make "their days long in the land?" Shall I interfere with Providence and turn them the other end up?

Prof. H. E. Colton.—If he will thoroughly season his posts and soak them in hot resin oil, that will make them very similar to the "lightwood" posts we have at the south, and they last forever.

Mr. Adrian Bergen.—Half the persons who put up fences do not let their posts season. Two years is short enough time. A post put up green will decay rapidly, no matter what is put on it.

Horace Greeley.—If he will observe a little, he will see the sense and reason why posts should be set top end down. The lower end of a tree was created by nature to absorb moisture more freely than higher up its body. If the top end is put downward, it will not absorb as much water—it is repelled by the pores of the wood, and will last one-third longer.

Mr. H. L. Reade.—I remember a fence I once helped to put up, and one-half the posts were set but end, the rest top end down. After several years the whole fence was taken away, and we found that one-half the posts were decayed, the rest sound.

Prof. J. A. Whitney.—The decay of wood, as is well known, arises from the fermentation or decomposition of albuminous matter contained in it. This fermentation can only take place in the presence of moisture. The first step then is to dry the wood thoroughly by seasoning, and afterward to keep it dry. I have read that there are chestnut rafters in old English churches that, having been so placed as to remain dry, have lasted for more than 800 years, and are as sound to-day as when the Saxon workmen fitted them in their

places. When the fence-posts are seasoned through, the ends to be put in the ground may be covered with coal-tar applied hot to keep the water out. If the tar is placed upon wet or unseasoned posts, it will only confine the moisture, and the wood will decay more rapidly than without it.

Bookkeeping for Farmers.

Mr. W. B. Renwick, Belfast, N. Y., asks for a good system.

Mr. J. B. Lyman.—Buy five little pocket memorandum-books, about four inches by six, costing two shillings each. On their outsides write—My Labor Bills; My Seeds and Plants; My Stock; My Fields; My Sales. Never neglect an entry longer than a week. Then have a larger and more expensive book in which you draw off the sum total of the results of each year, and in which you set down the value of your land, stock and tools. Each January draw up a statement of the balance of the past year as far as your sales are made. Also draw a map of your farm and number the fields, and keep a Dr. and Cr. account with each field. This system is just as good as Brigham's or Perkins'.

How to Make Trees Grow.

Mr. W. O. Duvall, Brentwood, Long Island.—In the spring of 1847 I set out an orchard of 1,400 apple trees; about 1,000 in regular form and 400 along fences and stone walls. These trees were three years from the seed, planted with my own hands, and budded when two years old, by the same hands. The land on which they were planted had been in corn the year previous, and after the corn was removed in the fall, was plowed beam-deep with a three-horse team. In the spring it was harrowed, cross-plowed, harrowed again, sowed with barley, seeded with clover and timothy, sowed with plaster, and rolled down smooth. With my horse and corn-plow, I then marked my land in furrows twenty-four feet apart each way. I then set out my small trees, the tops all clipped, leaving them only *three feet* long. Making the hill in the shape of an inverted saucer, putting but a light covering of dirt on the roots, leaving the *crown* of each tree above ground, I advised them to send their roots down into the deep, mellow earth below. The advice was kindly taken, and they grew to perfection. In the early spring of the six succeeding years they were duly mulched with coarse manure and straw from the barn-yard, and if there was not

enough of this stones were drawn for the occasion, and answered equally well. This mulching was scattered over the ground, away from the trees, at the approach of winter, as security against mice. During these six years, in early spring or in February, one-half of the last year's growth was cut off, in accordance with the A. J. Downing theory, thus making low and beautiful heads. Most of the land in this orchard was of good quality, but some was poor, yellow sand. Yet, the result was the finest and healthiest trees I ever saw, as a whole. The bodies of them being only three feet long, they soon became so shaded by their tops as to secure them from the ill effects of the burning midday sun, and were covered with a thin, curly, scaly bark, that gave them the appearance of "shag-bark walnut;" and yet, under that rough, protecting bark was the most smooth, green bark I ever saw.

At the same time of making the apple orchard, I transplanted about 1,000 sugar-maple trees, four years from the seed. These were clipped to the length of four feet, and headed in, as were the apple trees, for four years, and mulched, and otherwise treated in the same way.

Now, mark this: The ground about those apple and maple trees has never been plowed since their planting, but for the first 15 years a heavy burden of hay was annually taken from it. Since then the trees have so shaded the land as to prevent much grass from growing on it. Those trees, apple and maple, are now standing in the town of Mentz, Cayuga county, N. Y., and a gentleman from the city of New York, visiting me in the fall of 1864, when the orchard was loaded down with the finest of apples, nine-tenths of which were being picked with ease and pleasure from the ground, declared it was worth going a thousand miles to see. The maple trees have a whiter bark and larger leaves than I ever saw elsewhere. My own opinion is, after sixty years' experience, that the best way to guard against the ravages of insects is to feed the soil well. Fat cattle are seldom lousy.

RAISING TOMATOES FOR FAMILY USE.

Mr. G. A. McIlvaine, of Mount Pleasant, Pa., forwarded the subjoined account of his practice: First, to prepare the ground, I dig a trench about two feet wide and say, ten inches deep, throwing the soil to one side; then get into this trench and dig another ten inches deep, mixing in plenty of well rotted stable manure; then throw

back the soil, mixing manure with this also. This will raise a ridge four or five inches high, with a soil twenty or more inches deep. On the top of this ridge set the plants about three and a half feet apart in a single row. When set in squares they do not get light or air enough to ripen fast, and in wet seasons will rot before they ripen. Next, prepare frames, making them four square, flaring toward the top; make them of strips of inch boards and plastering lath, the lower rung about twelve inches long, and the top sixteen inches, and should stand out of the ground three feet; place one of these frames over each stalk; keep the ground clear of weeds, and let alone until the first fruit ripens, which you will find near the ground and near the main stem. By this time there is as much fruit set, or in blossom, as the vine can ripen, and it is time to commence pruning, not by lopping off leaves and branches, but if you notice you will find little bunches of leaves starting in the next fork above where the last blossoms are. This bunch of leaves contains another set of blossoms, and is what should be cut out with a pair of scissors or a sharp knife. The vines should be gone over every two or three days. Vines thus treated can reasonably be expected to yield one-half bushel ripe tomatoes each. One thing more, hurry them on as much as possible, so as to ripen them before the nights get cool. They lose flavor and become more acid in cold weather. I like to be done canning the first week in September, if not before.

Mr. F. D. Curtis.—Persons who adopt this system of culture will do well, particularly if they live in latitude north of New York, to cut off all growth of vine above the second setting. As much fruit will then be left as will be likely to ripen.

WHY GARDENERS GET SUCH HIGH WAGES.

Mr. T. B. Reed, Sagadahoc, Me., reads of large figures paid to good gardeners, and wonders.

Mr. J. B. Lyman.—The able gardener must know a great deal; he must bear much responsibility; and he must work very steadily. A green house must be familiar to him in all its departments. He must know the proper temperature for each room, how cool to keep his ferns, how hot his propagating bed; when to ventilate and when to keep his glass down. If a new rose comes out he must know of it, and get a cutting. If a rival gardener gets a remarkable dahlia, he must breed one still more extraordinary. He must know which strawberries suit his soil, which pea is the earliest

and which is the best. He should be able to make a squash weigh as much as he does. Of course Mr. Reed will see that such an array of talents cannot be employed for a dollar and a-half a day.

Manure Cellars.

Mr. H. F. Goodban, a young farmer in Franklin Center, Erie county, Penn., thinks he wants a water-tight manure cellar, and asks what cement to use.

Mr. Alfred B. Crandell.—The best farmers whose places I visit wouldn't have a water-tight manure cellar if it were made for them. They plan in another way. One gentleman I remember in Massachusetts, dug one of those vaults back of his cows, and every day the liquids were spooned up with a big wooden shovel and thrown into it. In April there were two days of slavery and filth in getting it out where it could be reshoveled into a cart. The best way is to compost it with so much of dry muck or straw, or saw-dust that the liquids are all made solids. This he can do by having tight floors, and for tight floors he can use tar cement. He should grade the earth below the stable floor so the fluids will run into a shallow gutter just back of the animals, cover the earth with an inch or two of stones of the bigness of an egg, that have been rolled in tar, that is, shoveled over while tar is poured on them; ram these down and cover with sand and tar, using sand enough to absorb the tar and make all stiff. If asphalt is mixed with the last tar used, a harder crust will be the result. The work should be done in August, and stand two or three months before it is much trod. The best results may not be expected without much ramming and rolling. But once laid, such a floor will last while water runs, and if he saves *all* that such a floor receives, he may count on as many *well manured half acres each year*, as he keeps head of stock.

Plant-Food — Ashes.

Mr. W. W. Adams, O'Bannon, Ky.—I desire to learn something of of land in East Tennessee, its character, climate, &c. Also, if ashes made from wood grown on limestone land contain all the elements necessary for the nourishment of plants except ammonia.

Prof. J. A. Whitney.—Ashes made from hard woods contain all the elements of plant food, except phosphoric acid. If wheat is sown on land deficient in phosphoric acid, it would not seed out well. Ammonia would also be needed. No manure pays the farmer as well as those containing phosphoric acid.

Mr. Horace Greeley.—The only trouble about wood ashes is we cannot get enough of them. I buy all that I can get. On any warm, dry, gravelly soil they are worth for use at least twenty-five cents a bushel. It is idle to deny they are of no use when every farmer uses all he can get, and would buy more if possible.

Mr. H. L. Reade.—I happen to have connection with a manufactory where we burn about 300 cords of hard wood a year, and we put the ashes on 140 acres of poor sandy land. I have there seen the most astonishing results from them. I would gladly pay twenty-five cents a bushel and haul them twenty miles.

Dr. Isaac P. Trimble.—How much do you put on an acre?

Mr. H. L. Reade.—About 130 bushels on the 140 acres. From comparatively worthless land it had been made valuable.

Prof. J. A. Whitney.—If some means could be devised of disintegrating feldspar, an abundance of potash could be cheaply derived.

Large Cheese Yield.

Mr. L. S. Farmer, Centerville, N. Y.—D. W. Cole in 1868 made 1,200 pounds of cheese from two cows, and 170 pounds of butter, all of which he sold for $269.40, besides using butter cream, &c., in his family: also fattening pork on the whey. He fed on shorts and mangold wurtzel, and cut hay in first blow. The cheese was made at a factory.

Adjourned.

PROCEEDINGS

OF THE

POLYTECHNIC ASSOCIATION.

A SOCIETY ORGANIZED BY, AND UNDER THE CONTROL OF, THE AMERICAN INSTITUTE.

The Polytechnic meetings are held weekly for the purpose of examining new inventions and discoveries, and discussing topics appertaining to Technology.

May 6, 1869.

SAMUEL D. TILLMAN, LL.D., in the chair; C. E. EMERY, Esq., Secretary.

The proceedings were varied and interesting. At the opening of the meeting Mr. Schmidt exhibited a model of what may be termed a submerged bridge or tubular passage-way, proposed as a means of crossing the East river. It is designed to make the structure of wrought-iron, braced internally by suitable frame-work, and formed in sections of suitable length. These sections joined together, the inventor claimed, could be sunk in the river at such depth as not to interfere with navigation, and yet at such a distance from the bottom as to secure the least possible inclination in descending to and ascending from the tubular passage-way constituted by the structure.

SANITARY PAINT.

Mr. Thomas Hodgeson, of Brooklyn, N. Y., presented several articles coated with a paint, which he said was not poisonous. The ingredients are somewhat similar to his composition for making artificial stone, which was exhibited at a recent meeting. The basis of the paint is composed of oxalic acid and lime, or alum, in combination with feldspar, or any of the substances containing alkaline earths.

Dr. J. J. Edwards remarked that he had seen a paint like this used in frescoing, over thirty years ago, but it was found not to be durable.

Mr. Hodgeson replied that the cause of that paint not being durable, was on account of its being composed chiefly of soluble glass, which would not stand, for any length of time, the action of the atmosphere. He had coated every kind of surface with his paint, and exposed them to very severe tests, without any preceptible change for years. This paint will cost about three-fourths less than the ordinary paint. The artificial stone made of oxalate of lime, alum and sand, was found to be insoluble in boiling water.

Dr. P. H. Vanderweyde said that all the salts of soda are exceedingly soluble, so, when they are combined with silex, they form soluble silex. Water-glass, when first used as a paint, was prepared by boiling potash with sand to the consistency of syrup; but this preparation was found to contain too much soda, which was easily affected by moisture. And this is the objection to soluble glass as a paint, the soda will not stand the influence of the weather.

Prof. Phin remarked that the French have used oxalic acid in the same way as stated; the acid being afterward washed with sulphuric acid. A full account of this process can be found in the Comptes Rendes. This shows that the principle has been used in France some time since, and has been well spoken of there.

Light and Color.

Dr. P. H. Vanderweyde gave an elaborate and interesting lecture on light and color, descriptive of the spectra of different gases, fluids, etc., and the manner in which the elemental constituents of solar bodies have been ascertained. He also explained the causes of the difference of color in various bodies of organic origin, as, for instance, the mother-of-pearl, which is secreted in the interior of shells and made up of translucent laminæ, the irregular surfaces of which break up the rays of light, and cause the development of color in the same manner that a similar result is produced when a glass surface is closely lined with a diamond point.

Hemisphere Model of the Moon.

Mr. Charles B. Boyle presented a carefully executed model of that side of the moon which is visible to us. He has used in his authorities Behr and Mœdler's famous lunar map, and the photographs of

Rutherford and De la Rue, supplemented by his own observations. This model was first worked out in wax, and subsequently cast in plaster. It conveys such an accurate idea of the moon's surface as physical maps or globes in relief do for the earth's. To enable the observer to see the mountains and valleys, their size in proportion to the diameters of the model has been exaggerated six times—the same as is necessary with models of the earth's surface—inasmuch, as if made to a true seale, the highest of the mountains would be shown only by an elevation of the one-thirtieth of an inch. Mr. Boyle read the introductory portion of an exhaustive paper on lunar observations, in which he brought forward a theory, original with himself, that the great basins that have been ascertained to constitute at least one-fifth of the moon's surface, are produced by the action of a liquid—probably water—instead of by volcanic agencies, as is commonly believed.

The paper alluded to will be given in full in the report of the next meeting.

IMPROVED TELEGRAPH WIRE.

Dr. I. F. Boynton, of Syracuse, New York, said he was the first man ever authorized by Professor Morse, to use his telegraph when it was first introduced in this country. He lectured on the electric telegraph in the principal cities, in order to induce people to invest in the enterprize; and illustrated his remarks by showing the working of the telegraph itself. Of the number of metals that conduct electricity silver is the best, but it is very costly, and for this reason cannot be used. Next in conducting power is copper, which is a weak metal and stretches very much. Now, what is wanted is a good, strong and cheap conductor. If made of soft iron it will stretch; and if constructed of steel it will be a poor conductor of electricity. The alloying of other metals with copper, to harden it, seriously affects its conducting power. It has been found that if two per cent of antimony is mixed with copper, it will render it a non-conductor. If a wire could be had as strong as steel and as good a conductor as copper, we would then have a very thin wire which would offer but little resistance to the winds and afford but a small surface for ice to hold to during the winter. For electrical purposes copper is seven and a half times better than iron, but its weakness is a great objection, and to make it strong it would have to be made too large for practical purposes.

Mr. Moses G. Farmer, of the city of Boston, a man who is second to none in his knowledge of all that pertains to electro-magnetism, has supplied that which has been so long wanted—a good, strong, cheap and light telegraph wire. In the specimen now exhibited we have a mile of wire wound in a coil, which is so light that a man can carry it on his shoulder. The ordinary telegraph wire of this length would weigh over one hundred pounds. When all other kind of wires failed on the great California line, this fine wire succeeded. This wire is made of fine steel, which is very strong; after being drawn to the required thickness, it is passed through a bath of pure tin, with which it becomes coated; then a ribbon of copper is rolled out and drawn over the steel wire, through a die; the wire is then passed through a bath of chloride of zinc, which cleans the surface and at the same time solders the copper to the steel. Thus we have a wire possessing the continuity of copper with the strength of steel. This wire has seven times the conductivity of iron, and is so light that it can be mounted on posts of but twelve to fourteen to the mile. Mr. Farmer has succeeded so well thus far, that there is every prospect of his making a conductor that will not require a repeater between here and San Francisco; a wire that will work with as much certainty as that between here and Albany.

Lightning Rods.

Dr. Boynton also presented some lightning rod wire, and said: While he was making some experiments in regard to lightning conductors, he noticed the cases where buildings were struck with lightning when they had rods on them. But he always found in such instances that the conductors were not made of proper materials. On being shown the telegraph wire of Mr. Farmer, he immediately saw that that was the article wanted to make a perfect lightning rod. The wire here shown is made of No. 7 iron wire. He has secured its use exclusively for lightning rods. The iron is tinned and copper put on it, and the copper is then tinned on the outside. And here is all that is required for a perfect lightning rod—strong, free from oxydation, and one continuous rod without any nuts or joints whatever. Two wires are twisted together, forming a very strong and durable rod. The machine for twisting these wires has been running but a few days, yet the demand for the rods is so great that it cannot be supplied.

Prof. Phin remarked that the question of telegraph wires was one

of exceeding importance. The requisites for a good telegraph line is strength and high conducting power. These seem to be secured in the invention of Mr. Farmer. But in regard to the lightning rod, strength, that is tensile strength, is not important. Iron is, we know, a good conductor, and if made soft, a better conductor. He could not see the difference between a good iron conductor and the one presented by Dr. Boynton; it was no safer. It certainly could not be better than a good copper wire, as was used by Sir William Harris. And to effect the same purpose an iron rod has only to be made seven times larger. The making an iron rod equal to copper is a mere question of expense, the weight of the iron having to be so much greater than the copper. The French Academy of Science some two years ago, made a report on the subject of lightning rods, and the committee recommended the use of pure iron as the best for making the rods; so there does not appear any new advantage in the rod here shown.

Prof. J. A. Whitney stated that the manufacture of the ordinary lightning rod is a special branch of business in itself, and these rods are made in sections of some twelve to fourteen feet long; they, therefore have to be put together in joints, which are apt to rust and work loose, and many accidents have occurred from this cause, but the rod here presented being in one continuous piece, is a recommendation in itself. The rod can also be put up by any ordinary workman.

Prof. Phin replied that these would be good recommendations if facts supported them. There were many places in this country where continuous rods were used. He had seen many in the city of Rochester.

In the course of the debate, foreign opinions having been frequently quoted, the chairman remarked that precedents and authorities would be excellent in a court of law, but that foreign authorities in the matter of invention were a little behind American practice. Almost every great invention of the present century has had its origin in this country. Should the present idea prove of value, it would be speedily adopted abroad. He would say, however, that very many of the lightning rods erected in this country are almost useless.

Dr. Boynton stated that particular attention is given to the quality of the copper used in these rods. A cargo of copper which recently came from Lake Superior, more than half of it was rejected on account of its containing some two and a half per cent of antimony.

Dr. L. Bradley said he wished to call attention to one point, and that was, as copper and steel have different degrees of expansibility, what would be the effect of the heating and cooling of these two metals? He apprehended there would be a serious change in their molecular arrangement. A lightning rod should have a bright point at the top, and good communication with the earth, and if it is at the proper height, it will protect a building from common lightning. as it will pass down the rod silently into the earth. But when a thunder-bolt, or what is called "ball-lightning," occurs, there is no lightning rod that will carry it to the ground; no lightning rod will protect a building against that kind of lightning.

Dr. Boynton replied that he had never known of "ball lightning" being near a good lightning conductor. The lightning rod is to prevent the thunder-bolts of the heavens from accumulating. This wire is so light that it can be stretched to nearly a straight line, and in this condition it has stood the heat and cold for over a year.

Dr. Vanderweyde remarked that he noticed a lightning rod on a house in Troy last winter. The rod was split and the painters put plenty of paint in the crack, thus destroying communication with the earth. Another rod on a church in Albany had the end of it resting on a wood-pile, the rod was a very fine iron one. In Germantown, Philadelphia, a building was struck by lightning, and he examined the rod, which he found the end to be embedded only eight inches in dry sand. The end of a lightning rod should go to where there was moist earth, or to a well or stream of water. The lightning rod here shown seems to be a very perfect one, free from oxydation and continuous; and no doubt when the French government, or Academy of Science make another report, it will be in favor of the one of Moses G. Farmer.

Prof. J. A. Whitney said that those who live in the city know but little of the effects of lightning. Here lightning seems to be a small affair, but the damage done in the country makes lightning rods very popular there. He had seen a small building on the farm on which he was reared struck by lightning and shattered to pieces. The ordinary iron lightning rods, made in joints are often put up by men who know very little about them, and hence we see so many useless ones. This is due partly to their mode of construction, and the want of skill in those who put them up. The lightning rod of Mr. Farmer seems to overcome these objections, as a flaw cannot

be made in it, and the rod can be put up by the most common laborer. These features should certainly render it worthy of adoption.

Dr. Vanderweyde remarked that the first lightning rod put up in Holland was in 1780, on a church spire there and this church has never been struck since. In Holland they drive iron bars, some twenty feet long, in the ground and attach the end of the lightning rod to them.

Dr. Wm. A. Weatherbee stated he had seen a village church struck by lightning which had a scientific lightning rod on it, but the rod instead of going into the ground, ran some three or four feet along the ground.

Prof. Phin stated that the lightning rod of Mr. Farmer, which was claimed to be made of steel, copper and tin, was not new, as he had seen rods made of iron and copper many years ago. The making of the rod of steel is not required as it is sufficiently strong when made of iron, for a lightning rod. The old plan of iron and copper rods was much better than the present one.

Dr. P. H. Vanderweyde said that Prof. Faraday in experimenting with electricity found that many points in a lightning rod interfered with the attraction of the lightning. A number of points on a rod is equal to a ball, which is not a good mode of attraction. It has been found that one point will be charged better than a number of points. One single rod tapered to a point, is much the best, as it absorbes the electricity from the air.

Among other items brought forward in the animated discussion which followed Dr. Boynton's remarks, was the opinion expressed by several that the insulation of lightning rods is absolutely useless, and that it is much better to attach them directly to the roof, especially if the latter be a metallic one. At the usual hour the meeting adjourned for one week.

May 13, 1869.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

Street Cleaning.

Mr. J. K. Fisher, in response to queries made at a previous meeting, read, as follows, a brief paper upon the subject of "Street Washing and Sweeping:"

The superiority of washing streets may be seen by those who observe the following facts: 1. Fully a third of the dirt is left on the

pavement by the machine and hand-brooms in Broadway. 2. A strong shower washes the pavement clean, excepting where there are holes, in which water remains and sediment falls. 3. In wet weather the streets are not swept, but mud accumulates for days and weeks; and the mud holds water like a sponge, and keeps the streets wet for days after the sidewalks would be dry, were the mud not tracked upon them. 4. The best time to wash a street is while it is wet; the washing engine would then use less water. 5. As soon as rain is over, the washing engines would do their work, and blow the dirty water out of the holes, and leave the pavement nearly dry, so that in half an hour it would be completely dry; thus saving the muddiness, which now lasts from two to six days before the contractor sweeps. 6. The cost of washing by hose-jet in Sheffield was less than half the cost of sweeping and cartage; proper washing engines would further reduce the cost. The washing would make less dust than sweeping.

Considering the mud avoided, and the little if any dust, the washing system would give more than double cleanliness, probably at half the cost of the present inefficient system.

The washing engines would be efficient fire engines, and would always be ready to leave their street work instantly when fires occur: their cost would therefore be little beyond what is now incurred for engines and men, who do but few hours' work in a year.

Floating fire engines could dredge the docks by jet, while the tide runs outward, and thus clear the docks from the street dirt, and at the same time serve as fire engines better than if kept inactive, without steam up and their fires strong.

Some of our sewer engineers say that the sewer gullies are not made to pass street dirt, but to catch it; and that, therefore, alterations would be required to make this proposed system practicable. Others say that much of the street dirt does go through the sewers. I am convinced, by evidence published in England, that the system is practicable with the present gullies, and that the gully traps are needed to catch the gravel that is often found in streets, and that might do harm in the sewers. Mr. McElroy's paper is good professional evidence against the hasty surmises of engineers who have not studied the subject.

An improvement in city engineering is needed. There should be a chief engineer, under whom the engineers in charge of the aqueduct, sewers, docks, fire department, etc., should serve. The chief should

control all departments. Then they would all work together, economically and efficiently. The hydrants would be large enough for the fire engines and for flushing the sewers; now they are not. The dock-cleaning and street-cleaning would be economically related. And all would be done better under one head. Now, each little chief thinks only of his own department, as if the city were made for no purpose but to be watered, sewered, gas-piped, or otherwise expensively and confusedly disturbed. When we have a talented chief engineer, we may look for the system I have proposed.

The blowing apparatus alone will dry the streets after a rain. An engine of this kind would blow dust from country roads and from railways; and I intend to patent it for those uses, as well as for streets.

Dr. J. J. Edwards remarked that in London, when the sewers were found to be defective, they adopted the system of flushing them with water, and with marked success. There was no reason why the dirt of the streets should not be carried off by the sewers. It would not clog them up any more than it does after a heavy fall of rain. This system might also be applied to getting rid of the snow in the streets in winter. The snow cannot be well carried off, so this plan would seem feasible.

Mr. Fisher thought that it was pretty well agreed here that the snow should be cleansed out of the street. Mr. Ebbitts, when superintendent of the Sixth Avenue Railroad, said it was much cheaper to clean the streets of snow by the use of salt than any other mode. He, Mr. Fisher, had seen, in London, the mud scooped up in buckets and carried off in water-tight carts. The plan of washing the snow away was a good one and might be made effective.

The Chairman inquired if Mr. Fisher intended to clean the streets with water when the temperature of the air was at or below the freezing point?

Mr. Fisher replied that he had not given that part of the matter full consideration. One mode of cleaning the streets was to throw the water up well with a fire engine and let it fall to the ground. As the steam fire engines are at hand this plan could be tried without hardly any expense.

Prof. J. A. Whitney said there were quite a number of plans proposed to remove the snow from the streets. One plan was to lay pipes through the streets to be kept full of hot water, which would keep up a temperature above the freezing point. Another plan was

to throw a jet of steam down on the snow. This idea it is evident would not work well, as the heat would be absorbed from the steam by the atmosphere before it reached the ground. Another device, and one which would seem to have some merit in it, was to have a machine which would carry the snow to an elevation, and heat being applied underneath the snow would be melted and run off. And still another plan was to pump water up into a reservoir, sufficiently high to give the requisite pressure, and using the water to wash the snow away. A gentleman in Philadelphia proposed the use of salt water for this purpose, but the salt water would not work well only on water tight pavements. This whole matter of getting rid of snow in the streets is merely one of expense. The question is, would the benefit derived warrant the expense?

Mr. C. E. Emery remarked that a large hose will wash the streets very perfectly. If a stream of water could be made to run in our gutters, it would do away with many of our gutter nuisances. Any plan to keep the streets free from snow, he thought, would not be practical, as the amount of snow that falls during the winter is much greater than we dream of. In Brooklyn, where they use salt on the tracks after a snow storm, the cars are running some two weeks before they are in this city where its use is prohibited. The salt water, however, should not be allowed to remain in the streets, but should be washed into the gutters and sewers; if this was done much of the evil of salting would be removed.

Dr. J. J. Edwards said that wherever salt water is used there most certainly will begin a state of dampness, and in our crowded neighborhoods we would do a great wrong if we obliged the people there to breathe a damp atmosphere.

Prof. Phin stated that a very heavy fall of snow rarely gives more than half an inch of water. The amount of snow that falls in many of our heavy storms is far lower than ten pounds to the square foot. In regard to the use of salt, a singular fact occurred in France where it was used to sprinkle the streets to keep down the dust; yet a great objection to it arose from the oppressive dryness which it occasioned in the atmosphere, the salt had to get moisture somewhere, so it absorbed it from the atmosphere.

Prof. Whitney thought there must be some error in this statement, as whatever moisture might be abstracted from the air at the surface of the earth, would be regained by the air absorbing the moisture from the air above.

Mr. Emery stated that he had seen the experiment tried of melting snow by throwing a jet of steam into a snow bank, the effect was trifling; hot water was then used, which showed a marked difference in favor of the water.

Improved Money Drawer for Stores.

Mr. —— Zwahlen exhibited his improvement in desk and money drawers, the main feature of which was having the cleets that the draw slides on, placed on the inside of the drawer. So that the drawer cannot be taken off by unscrewing the cleets, as is sometimes done. A number of secret springs were attached to this drawer, which prevented it being opened except by those knowing their location.

New Artificial Stone.

Mr. H. G. Hubert presented a number of specimens of Mr. F. Coignit's method of monolithic concreting, and read a paper written by Mr. Coignit, descriptive of certain new methods of preparing the variety of concrete known as *beton agglomere*, and recently introduced in this country from France. Of this paper we make a short abstract or condensation as follows:

A company has been formed in France to work the invention, and has a large establishment, covering about twenty acres of ground, at St. Denis, near Paris. Here are manufactured from the *beton* all the various forms of stony material required in architecture, engineering, the decorative arts, etc. As specimens of the capabilities of the material, the company have constructed on their grounds a monolithic arch, having an opening of two hundred feet, with only about one yard of transverse section; also a five story building; also a monolith. It has been very extensively adopted in various public works in France; among others, in the monumental abutment walls of some of the boulevards; in the great collecting sewer of Paris, which is simply a huge pipe 1,800 feet in length, and nine feet by twelve internal dimensions; also, the branch sewers, having an aggregate length of ten miles; in the aqueduct of La Vaune, requiring upward of 5,000 yards of arches, 18,000 yards of tunneling, bridges of 100 feet span, and similar engineering works, the whole of which, when completed, will constitute a continuous and unbroken structure, thirty-eight miles long, of the *beton agglomere*—the latter having been substituted in the construction of some of the bridges for iron, the material originally proposed for them by the

government. Many other instances of the use of the *beton* on a large scale were cited; as, for instance, the sewerage systems of Melongé and Odessa, the lighthouse at Port Said, and others.

The material is made of the usual ingredients, lime, sand and hydraulic cement; the novelty of the invention consisting in the mode of mixing and combining the constituents. This is done by grinding them together in a mill of peculiar construction, and with a much less proportion of water than is used in the preparation of ordinary concrete; also, in the mode of forming the monoliths by ramming the material at intervals in such manner that it is thoroughly compacted or agglomerated, and its strength very much increased. Specimens of the material eighteen months old, and composed of four parts sand, one part lime, and three-fourths of one part hydraulic cement, were found to possess a crushing strength of upward of 520 kilogrammes per centimetre, or about 8,000 pounds per square inch. It is proposed to use the new concrete not only for monolithic structures, and for pavements, ornamental and other portions of buildings, etc., but also for railway sleepers and various similar purposes.

The new process drew forth considerable discussion, and on account of the cheapness of the materials employed, it was thought it might be of great use in some parts of our country.

Mr. Charles B. Boyle, of New York, read the following paper

ON LUNAR FORMATIONS.

Mr. Chairman, Ladies and Gentlemen.—In presenting for your consideration the claims of a kindred world, I shall call your attention to facts and peculiarities in the structure of the moon's surface, which appear to me to require a very different interpretation from that hitherto placed upon them. I shall endeavor to show that the lunar formations are but the mechanical results of forces developed by the action of a fluid as mobile as water.

The facts I shall sustain by reference to the photographs of the moon itself, as well as by the model, which, when compared with the photographs, will be found to be a faithful transcript; for, in no case have I modeled my own observations unless they were amply sustained by one or more of the various photographs in my possession.

In preparing the model, I have availed myself of all the intelligence which I could collect for a number of years past, amongst which will be found the labors of all the most distinguished obser-

vers, as well as the photographs of Rutherford, Draper, De La Rue and Whipple.

Upon a model of this size the greatest height of the lunar mountains, from the bottom of the basin to the apex of the rampart, would be represented by the thickness of an ordinary sewing needle, the one-third of which would represent the maximum altitude of the mountains above the common level of the moon's surface, and as this would furnish such slight elevations that they would resemble mere scratches, I was forced to increase the altitude six times; but as we are compelled to resort to the same means, and for the same reason in modeling the mountains of the earth. I merely notice it as one of the necessities which present themselves in constructing a model small enough to be made available for popular purposes.

Ring Mountains and Ray Systems.

That the ring mountains and the system of rays which so frequently proceed from them, are but the co-results of a common cause it would be superfluous to argue, as it never has been disputed; and they may be considered the grand feature of lunar topography. The basin called Tycho exhibits the most extensive example of this character upon the hemisphere of the moon which is turned toward us, though that of the basin called Copernicus has evidently been upon a scale of equal magnitude; but as it belongs to an epoch much more ancient, causes have been at work upon its structure producing modifications which have denuded and smoothed its original aspect, and consequently obliterated its ancient forms in proportion as they were less strongly marked.

A perpendicular section cut through the center of the basin Copernicus would be represented by this diagram. It is fifty-six miles in diameter; its circular rampart has an altitude of nearly two miles above the floor of the basin, while from the center of the inclosure a rugged mountain rises to the height of 2,400 feet. The basin of Tycho is two miles narrower than this, but the rampart wall is one-third higher and correspondingly more rugged, broken and picturesque, with a center mountain differing in like relations from that of its more ancient relative.

The full moon photographs beautifully illustrate the system of bright streaks which radiate from Tycho, several of which may be traced from 600 to 1,000 miles, and one to a still greater distance from the center.

Some of these ring mountain formations have a diameter of over 150 miles, while upon the other hand they decrease in magnitude until they cease to be visible in the telescope; many of them, also, though perfect types of the ring formation have no system of streaks radiating from them, and this peculiarity does not depend upon their size, as some basins that are much larger than Tycho have ray systems, while all sizes, including many of the very smallest, project rays varying in quantity, magnitude and intensity. As they decrease in magnitude, however, the aspect of the rims becomes less broken and rugged, until in those of the lesser diameters the rampart becomes smooth, and the interior regularly concave, but as their general characteristics are the same, it follows that they are all alike the result of a common cause.

As the ring mountains decrease in size, their numbers increase in a corresponding ratio, and the smaller a basin the more recent seems to have been the period of its formation, if we may judge by the sharpness of the outline as compared with that of the larger rings, from which we may infer the progressive modification of the active forces which have constructed the topography of the moon's surface, and it would also indicate that anciently, that whole globe must have been in a condition in which the material directly producing the force acted in large masses, and, therefore, with corresponding power; hence the early results present the most marked evidence of violence.

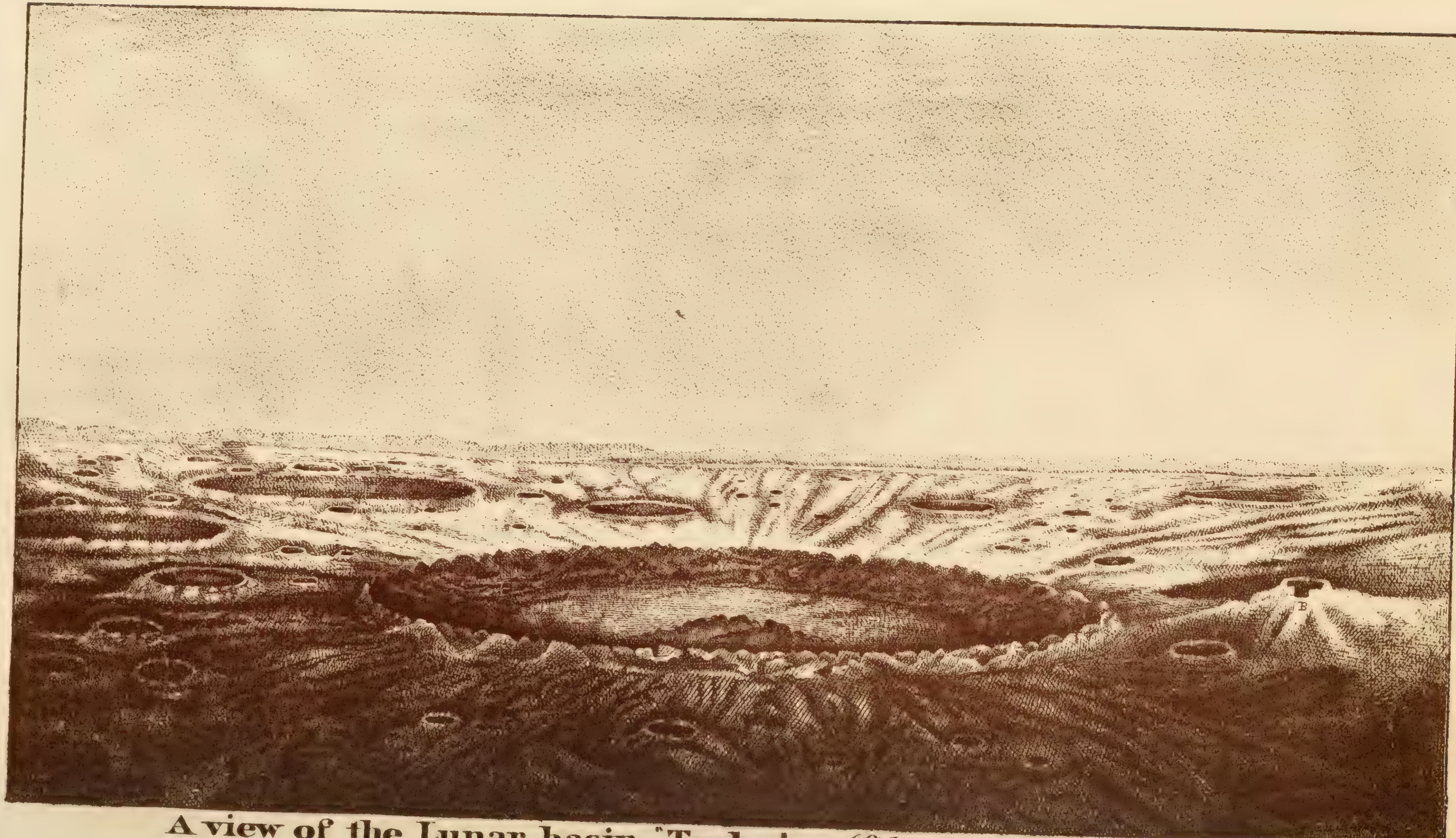
As geological epochs rolled into the past, the active agent became more generally disseminated as a necessity of the very modifications it was engaged in producing, and the more general dissemination increasing the number of points to which it was directed, decreased in the same proportion the individual volume of the active agent, and, consequently, the violence of the force with which it acted; hence the gradual diminution in the size of the ring mountains, until the miniature proportions of the younger members of the family remain yet to be discovered by an increase in the power of the telescope.

The ray systems which proceed from the ring formations are always higher in the immediate neighborhood of the center, and decrease their altitude in proportion to the increase of distance from that point; this is shown by all the examples which are favorably situated for observation upon the moon's surface.

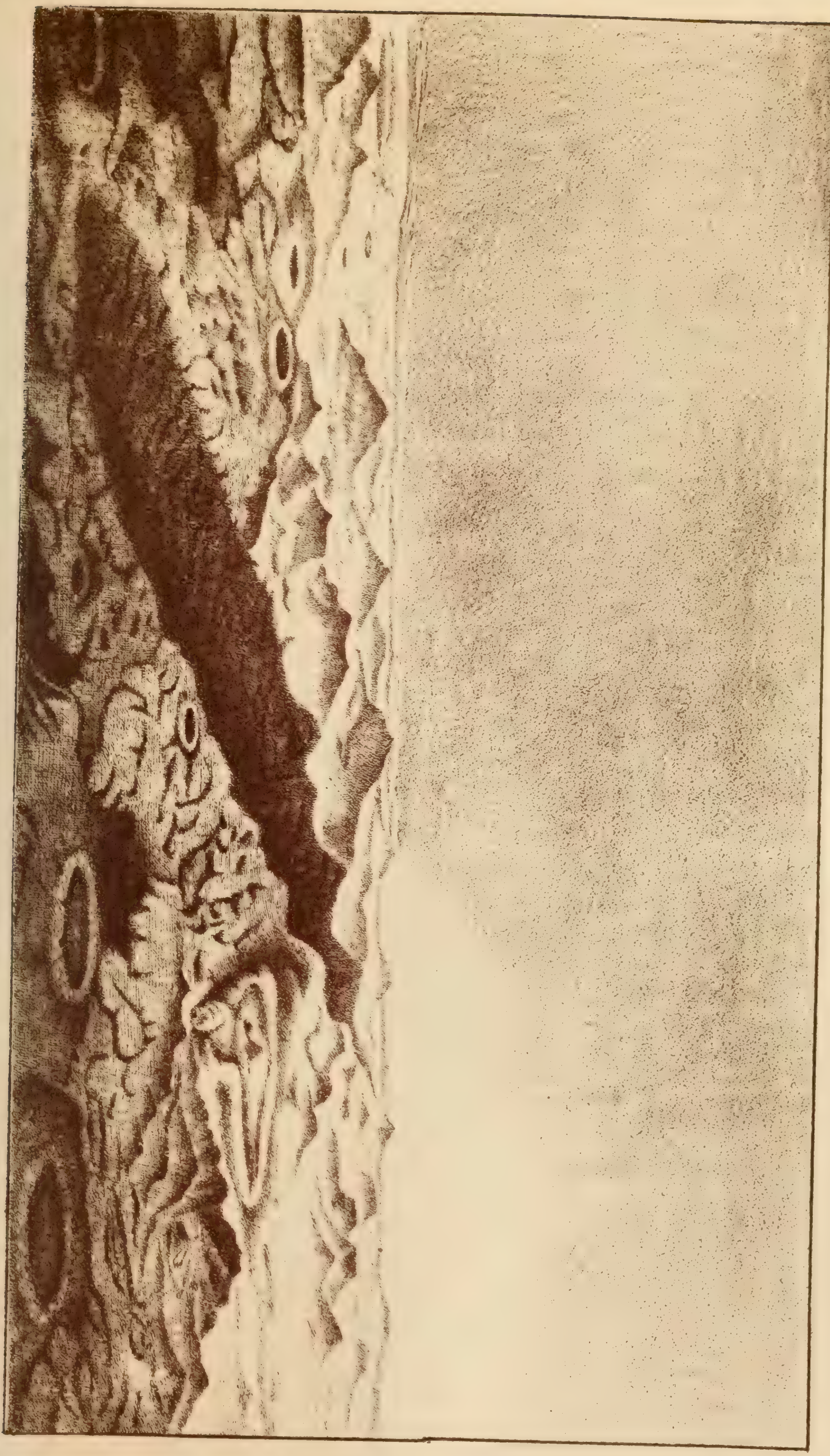
In the stereoscopic pictures made by Mr. Whipple, of Boston, with the Cambridge refractor, a small sized ring formation named Thales, comes in such a position upon the terminator, as to show very dis-

tinctly the character of the rays which proceed from it. The four largest form mountain ranges of considerable magnitude; one of which runs directly away from the observer; and though distinctly elevated at its point of emanation, far above the general level of the moon's surface, it gradually lowers until, before disappearing over the opposite horizon, it has spread itself like a delta amongst the ordinary debris of the surface; another, which takes a direction nearly at right angles to this, forms a grand mountain range of nearly 500 miles in length, decreasing in altitude, but widening as it recedes from its source, until it finally breaks like a great stream against the rampart of Gauss, a ring formation 110 miles in diameter; here it is lost and dispersed, like its companion, over the common level; a third and fourth take still different directions, and have all the characteristics of their fellows, though not of equal magnitude, while in the angles formed by those ridges other rays emanate in mass, as it were, without separating into ridges, submerging the surrounding country as they proceed until all traces of their destructive character is lost in the ordinary surface level, leaving a very gradual descending grade from their center of emanation outward, while transversely, or across the rays the surface would be comparatively level. The greater part of the grand ray system which surrounds Tycho, is of this character, though careful observation will show a difference of level between the brighter streaks and the portions in lower tints, but as a general thing they are very badly situated for observations in this respect, as the rays of the rising and setting sun are nearly parallel to the finest groups, and therefore unfavorably situated for developing the delicate markings of light and shade which a surface so nearly smooth will give under the most favorable circumstances. But there is one of those streaks which radiates from this basin, so different in appearance from the rest of the group as to make it evident at a glance that it must have had a history peculiar to itself, and that local causes have operated at an early period of its formation to produce the distinctive difference of character which it presents.

It is well known that upon our earth, rivers which form delta like the Nile or the Mississippi, build their own banks above the general level of the deposit; and if we could imagine about ten miles of the Mississippi abandoned by its waters, we would have a tolerably fair miniature representation of this mighty lunar chasm of somewhat over 300 miles long. The massive banks of this structure rise far above the surrounding country, overtopping even the ram-



A view of the Lunar basin "Tycho" *(fifty four miles in diameter) and its surroundings, with the volcano of Manua Loa (B) introduced upon the same scale. From the original painting by C.B. Boyle.*



parts of a ring mountain, which projects from the lowlands by its side.

The dark portions of the moon's surface, formerly supposed to be seas, approach Tycho, upon this side, much the nearest, as if the country in every other direction had been submerged by the material of which the rays themselves are composed. The banks of the chasm retain their distinctive character as rays much closer up to the parent basin than any other ray which proceeds from it, leaving the inference that the flow was intercepted at an early period in the history of Tycho and its surroundings, which would account for the ancient formations on that side having escaped submergence.

This great double ray partakes of the common elevation in the neighborhood of Tycho, while its altitude decreases as its distance from the center increases, until its distinctive character is finally lost in the low-lands, showing that the system of Tycho, like all the other ray systems of the moon, is highest at its connection with the central basin from which the flow has taken place. But this is so universally accepted as being the case, that I notice it here merely to call attention to it, as it points with peculiar significance to the causes which produced those structures.

EVIDENCE OF SEDIMENTARY DRIFTS.

It often happens, that when a ray encounters the rampart of a ring mountain, that it finds its way into the basin through the fissures and fractures between the craggy masses of which the ring is more or less composed, in which case the debris swept from between those masses may be found in the form of drift under the inner wall on the side next that from which the ray proceeded. This appearance of drift frequently spreads itself over the whole floor of the basin, leaving it marked with streaks of different degrees of light and shade; such a ray usually continues across the basin, passing out at the opposite side from which it entered, showing that whatever the active agent might have been from which the ray was deposited, that it was of a nature which admitted of its readily obeying the direction of the impulse impressed upon it. That it was not lava, is demonstrated by the fact that the basins across which those rays pass are never filled up, but merely marked to a greater or less degree with forms suggestive only of sedimentary deposit on which the shadows of the rampart are still cast by the rising or setting sun, showing that their surfaces are much below the river, and as

the ray continues, often for hundreds of miles beyond a basin which it has passed over, it is evident that the fluid agent from which it was deposited must have filled the basin up before it could by any possibility pass over it, all of which implies that the rays are but the sedimentary traces of the agent which produced them; had it been lava, the basin would have remained full.

When the ray is continuing its course, passes out of the basin the drift from the fractures through which it has emerged is invariably to be found outside of the wall, and resembles exactly the forms of the drifts of clay and sand which may be found in the bed of any stream on the lower side of islands, boulders, or other obstructions which may have intercepted the flow of the water. A fine example of this formation is to be found in the first quarter moon made by Mr. Rutherford. In this it will be seen that some of the rays from Tycho have almost depleted the ramparts of several rings, including those of Stofler, Fernelius and Nonius. Here the larger masses of the rims which survived the action of the depleting force, have, behind them on the side, away from Tycho, the peculiar drift formation referred to. Wherever a small cone of the lesser formations has survived the action of the force which may have directed the ray against it, the course of the ray itself will be changed, or else leave the appearance of a long line of drift behind the obstructions after sweeping round its base.

Speaking in a general way, the ring formations have an altitude on the outside of something less than a mile, and on the inside they are nearly three times this height from the apex of the rim to the floor of the basin. Then, if we suppose the surface of the ray formation in the immediate neighborhood of Tycho to be even a mile above the general level, though in fact it is never so high as the ring of the basin, but even if it were, it would not then have a descending grade of over seven feet to the mile, and assuming this to be a fair representation of the ray systems of the moon, you will at once perceive that such a fact alone removes the whole of the lunar formation out of the catalogue of volcanoes. Such gentle grades as this could only be formed by matter in a fluid state, as mobile as water; nor could water flow over such slight inclinations if it were very deeply laden with sedimentary matter.

VOLCANIC ORIGIN OF THE LUNAR FORMATIONS DOUBTFUL.

The volcanic cones upon the surface of the earth are very few and far between, while upon the moon the basins called volcanoes may be

reckoned by thousands, and their aggregate area would cover over one-fifth of the whole surface, not including those which are more or less obliterated by time and modern eruptions, and the remains of which may be traced almost anywhere upon the surface, showing a total dissimilarity in the two cases, as no globe could contain a sufficient quantity of interior fires to have produced such an extended result and be identical with our volcanoes and the forces which produced them.

Tycho presents itself as a fair exponent of the ring mountain formation, and the ray system which radiates from it in every direction proves it to have been a single vent, though it is fifty-six miles in diameter, and there are others which are three times greater than this, while single volcanic vents are comparatively mere points, besides a volcanic crater is but a depression in the top of the mountain which it forms, while the lunar basins have their floors depressed three times as far below the apex of their mountain ramparts as that apex rises above the general level of the moon's surface upon the outside; showing conclusively, that they have no characteristics in common with terrestrial volcanoes, and if it be a truth that like causes produce like effects then they are not volcanoes in any sense of that word.

Ancient Ray Systems and Basins.

A further evidence of the fluid nature of the agent employed will be found in the ray systems which proceed from the basins of Copernicus, Kepler and Aristarchus. Those three are amongst the more ancient formations, and the dark shade from the lowlands in which they are situated has spread itself over all their features, hiding and obscuring nearly every characteristic but the streaks and the basins themselves; but this has the effect of revealing the ray system with greater distinctness and, consequently, enabling us to trace it with more accuracy.

The basin Copernicus is about four times longer than either of the other two, though all three are evidently of the same epoch. The rays from Copernicus, which proceed toward Kepler, show by the results that the active causes which produced them have overpowered the force which was evolved from Kepler in the opposite direction, pushing back the flow toward the latter basin, compelling it to make a circuit around its source, though at some distance from it, as if the energy of the lesser volume, naturally gathering strength as it was driven back upon the point from whence its power was derived,

finally arrested the further advance of the superior invading volume, and, as the two opposing forces became balanced, they obeyed the well known laws of force, which prevail on our own earth, by uniting and taking a new course oblique to both the former directions. The branch of this united flow, which takes a northeasterly direction, encounters again the flow from Aristarchus, and the resulting forms are singularly suggestive of the nature of the agent which was active in the conflict, for it has left markings of too significant a character to be mistaken for those of any fluid less mobile than water.

The united flow from Kepler and Copernicus has pushed back the emanations from Aristarchus until its farther advance has been arrested by the mass of solid matter accumulated in the immediate neighborhood of the basin, forcing this flow to take a new direction, which is, as before, a compromise of all the forces and obstructions engaged, but the local obstructions here play quite an important part, for the ring mountain Herodotus, which lies beside that of Aristarchus, opposes its rampart to the invading current, as if in aid of its neighbor, the result of which is the formation of a plateau, which connects those two basins, and present an effectual barrier to the further advance of the flow in this direction; and now, as other rays which project from Copernicus strike this point directly, the united flow again takes the direction due to all the forces involved, and is driven sharply around the battlements of Herodotus; while another section has been driven around that of Aristarchus in a similar manner. Those two streams again unite in the rear of this obstruction, forming a rugged triangular valley, and then flow on toward the eastern limb for several hundred miles, meeting with similar adventures, in which, however, the conflict has not been so stern nor the results so characteristic.

Speculations Upon the Mode in which the Force Acted.

Now, before submitting the facts to your criticism, I will take the liberty of giving you my views as to the nature of the active agent which produced the results referred to. I infer from the facts presented, that a fluid, such as water, was the real agent employed, and as I find water so much more abundant on our own earth than any other fluid—that it also bears a like relation to the other planets, which is proved by their cloud systems and snow zones, and that it has been lately discovered to be a component part of the sun itself; I, therefore, assume that it was water.

The vast area of country in the moon, which has beeu overspread and submerged by the matter evolved from those basins, shows that the more external coatings of that body during that epoch, were of a sedimentary nature; perhaps not unlike the lighter alluvial soils of our own earth; and the process of creation, like all things else, being progressive, it must have been matter changing from one form into another; and as all celestial globes are but the mechanical results of chemical causes, it follows, that before they were globes they must have existed in a form of matter which admitted of mechanical manifestation; therefore the particles must have been free to move amongst each other, and the process must have been one of progressive consolidation from a lesser to a greater degree of compactness; consequently the whole mass must have been lessening in bulk, and, as a natural condition of such a process of construction, the various elements and compounds would take their place from the center outward, in the order of specific gravity. Water, then, both from this cause and from its power of sinking through earthy matter by filtration, as it does upon the earth, would take its place below the surface envelope; but as the process of contraction proceeded, a time would necessarily come when the crust would begin to exercise such a mechanical pressure as would gradually force the water back to the surface, similar to the manner in which it may be forced from a sponge.

The five conditions of the particles which would form the surface envelope of such a mass, would warrant the assumption that when they were brought in contact with water they would become plastic, and in that condition would the more effectually resist the escape of the water from within; the action of the sun upon the upper surface would have a tendency to harden it; its resistive energy would therefore be reinforced, and as the operation of compacting slowly proceeded the reaction of the enveloped water would as slowly upheave the plastic crust which imprisoned it at the points at which that crust presented the least resistance by its weight or local structure. The surface thus elevated would naturally take the form of a very flat bubble or dome, the lateral dimensions of which would depend upon local conditions; and the amount of force developed would be in proportion to the degree of tenacity with which the segment of surface upheaved had resisted the escape of the water. As the power of resistance of the crust is necessarily limited, and the force developed constantly accumulating, a time will come when the

structure must yield; then the mechanical action and results would be exactly the same which would follow from the yielding of a dome of similar construction upon our earth. The force exerted would be outward, in a direct line from the center to every point of its rim, and of course the sum of all this force, by its reaction, would be directed back to the center; therefore the first point to yield must be at one of those localities; and when a fracture is once made the immediate ruin of the whole structure will follow, because the sustained weight becomes at once unequally divided, and forces are instantaneously developed which direct themselves with sudden violence to every point upon which the dome had previously depended for support, and consequently, the evidences of the catastrophe will be most conspicuous at the center and the rim. The spreading of the dome segment will be a mechanical consequence of its yielding. and this by the mere outward force it exerted, would upheave mountain masses all around the rim; while the sudden outward rush of the water to escape at every point, would greatly add to the forces developed by the falling dome, and the result would be the formation of the rugged ring mountains which inclose the larger lunar basins.

The sudden action of the forces engaged would also be felt with corresponding energy at the center, because all the force which upheaved the rim would by its reaction be directed to the center, where a fracture would also occur, and the fragments also be upheaved, both from the natural action of the sinking dome and the energy exerted in an upward direction by the waters from below, upon the surface of which rested the enormous weight of the crust it was sustaining; the result of which combined action would of course be the center mountain common to lunar basins; and as the superincumbent earth was gradually lowered to the bottom, fresh fragments would be broken off around the rim, just as we see ice breaking from similar causes; this would leave the terraced formations to be found upon the interior slope of the ring mountains, while the convex floor so frequently met with is but a slight modification of the upper surface of the dome as it existed before its fracture. As it sank gradually down upon or through the sustaining waters until it found a more solid resting place upon the bottom, its characteristic form would be retained, being supported from below by the plastic sediment or clay filling up the concavity of its lower surface.

Now, if it so happen that the body of water which produced the structure is not in communication with sources of constant supply from the

interior, the result will be a mere ring mountain and basin without rays; but if the interior sources be in communication with the basin in such a manner that the flow becomes more or less constant throughout a protracted epoch, the sedimentary matter evolved with the water will be deposited along the courses in which it will be directed in the flow from the basin, and the extent of the supply will be represented by the ray system which it developes ; and though the flow may not be very great in volume, yet when it is continued throughout geological epochs, the traces it leaves behind may be very mighty in extent, while the lightness of the lunar earths would naturally increase the quantity disturbed by the water and carried in its flow.

The water evolved will be reabsorbed by the earthy surfaces over which it flows, the same as upon our earth; and all the causes combined will have a tendency to distribute it more evenly throughout the envelope, as well as preventing it by mere mechanical pressure from descending so deeply as before; the rings will become smaller for want of large supplies of water at any particular location. The examples of violence before referred to will become graudally less, and finally cease from the absence of the causes which formerly produced them, all of which will of course increase the number of points at which the water will issue. The size of the basins will gradually diminish as their number increases, until small fountain basins are, as it were numerously developed over the moon's surface, which, after all, is equivalent to the natural distribution of that fluid upon our own earth; for though upon the moon, water is evidently far less abundant than upon the earth, the process of distribution which the lunar formations so significantly suggest will make it sufficiently plenty everywhere for the sustenance of vegetable and animal life.

Significant Testimony and Speculation.

The London Atheneum has the following statement which presents a singular piece of testimony in support of this theory. It says: "In a short paper read lately before the Royal Society, Prof. Phillips has embodied some of his principal results. A skillful draughtsman, he has made numerous drawings of different parts of the moon's surface, and representing the same object as seen by morning light and afternoon light, he reverses the shadows and obtains a more accurate knowledge of the real forms of mountains and craters than is possible with a single light. In one of Prof. Phillip's drawings there is

a strip which so perfectly resembles a long river flowing from a crater like reservoir to a lake that to believe it anything else than a river is difficult."

To account for the absence of large bodies of water upon the moon's surface, we have only to reflect that the facts demonstrate the quantity of water pertaining to the moon to be relatively but a mere percentage of that belonging to the earth; and the earthy matter of the moon being lighter than that of our world, its tendency to absorb moisture would be greater in proportion.

The atmosphere of the moon being lighter than that of the earth, in the relative proportion of their solids, could not, of course, sustain the vapors of water, in such a form as the cloud system of our world; but even the earth's atmosphere cannot sustain the vapors of water in a visible form, at a greater elevation than about three miles above the sea level, and at this elevation the cirrus cloud becomes so thin as to be almost invisible. Nor is it improbable that the lower strata of the lunar atmosphere really sustain a cloud system, even more dense than our cirri. Indeed, some observers do assert that they have seen light clouds floating over the moon's surface, and the lunar clouds to become visible at all must be denser than our cirri, for every observer knows that a cloud of considerable density may pass between the telescope and the moon, without perceptibly affecting the definition. And our cloud is so near to the telescope that it covers the whole disc of the moon, but if it were removed to the lunar surface it would cover only a mere speck, which would make it excessively difficult to find at all, especially as there is nothing to relieve it from the luminous disc of the orb. And from this cause alone the moon's of Jupiter become entirely invisible throughout three quarters of every transit of the planet, and when an opaque body becomes invisible in its passage across a luminous disc, you will see how small our chances have been of determining pro or con the existence of lunar clouds.

The question of the extent, nature and power of refraction of the assumed lunar atmosphere necessarily connects itself with this part of the subject, but the time required to present those considerations makes it necessary to pass them over for the present.

It will be evident from the nature of our own earth, that whatever fluid was active in producing the lunar formations must be there still; because it could not escape from that body any more than the fluids of our own earth can escape into space. The heat of the sun

could only change them into a condition which would enable them to ascend into the atmosphere to a very limited extent, from which they would be as inevitably precipitated by the withdrawal of the causes which elevated them; and if the moon has no atmosphere, as astronomers assert, then its escape from the body would be utterly impossible.

Nor can the climate of the moon be the frozen region which some astronomers have asserted it to be, for no fluid could have flowed for hundreds of miles over such very gentle grades throughout the long periods of geological epochs without being congealed by the slightest frost, and, consequently, arrested in its flow.

As astronomers have ascribed the formation of the lunar mountains to volcanic action, asserting, at the same time, that the moon had no atmosphere, and, therefore, no elements to denude or soften the rugged outlines originally produced, the belief was accepted, and assertion followed, that the mountains of the moon were peculiarly broken, savage and precipitous.

Now, when we consider that, as a general thing, the mountains of that body rise above the common level of the surface only about one mile, while those of the earth attain an altitude of four, five and six miles, it follows that the original ruggedness of the lunar mountains must have been a very humble imitation of that quality in those of our own earth.

Neither fact, nor observation, however, sustains this rugged theory of the lunar formations, and there is ample evidence to prove that denuding causes have been both active and powerful upon our associate planet; and, indeed, if there were no denuding agents, the structures would all have retained their original forms; it would have been impossible to distinguish modern formations from those of former epochs, and the surface of the moon would have looked alike in every part.

Optical Testimony.

If we compare the basis and surroundings of Tycho and Copernicus we shall see that the causes which produced them were identical; that the formations themselves are merely of different epochs, and indeed, the whole structure of the basin and ray system of Copernicus shows that formation to have been a very worthy ancient representative of the more modern Tycho in every respect; and this being the case, it follows that the entire region about Copernicus as well as the basin

itself must have undergone very remarkable changes since the period of its activity, for it has become so dark and smooth as to be closed now amongst the "desert wastes" in contra-distinction to the bright rugged appearance of the more recent formations.

If those regions were merely the earlier formations smoothed down into "desert wastes," they would have become brighter instead of darker in appearance, because no matter what may be the nature of any material, the smoother its surface the more light it will reflect; consequently those ancient regions have not only been denuded and smoothed, but some other change must have been added to have produced the dark shade which they present.

If we examine the ray systems which emanate from Copernicus, Kepler and Aristarchus, we shall find that the darkest portions are the lowest, and in ascending from the valley toward the apex of the streak or rims of the basin, it becomes gradually lighter until the higher regions come out in light. Now, if an observer upon the moon turned a telescope upon the mountain region of our own earth, exactly this phenomenon would be presented to his view; and it would be occasioned by the mountain tops being bare and consequently reflecting more light, and as the vision descended into the valley, a gradual darkening would take place in the exact proportion in which vegetation increased in luxurious development.

The sun itself bears testimony in the same direction. Those dark regions appear of a luminous gray in which the blue predominates, and consequently they should photograph more brighter than they look—instead of which they take so darkly as to resemble very much the effects produced in the photograph by our own vegetable greens, which implies that the color seen in the telescope is not that of the actual local color of the so called "desert wastes" of the moon.

If those regions were either red, yellow or orange, they would photograph almost or quite black; but as the tints which they give are not black, and yet sensibly darker than they appear in the telescope, it follows that the true color must be a compound of blue, with red or yellow; it cannot be a compound of the three primary colors, as that would be gray, which would photograph just as it appears; nor can it be the compound of red and blue, which is purple, because that effects the photographs just like the grays; consequently the facts force upon us the conclusion that the true color ot those so called "desert wastes" is green, as that is the only compound left in the whole chromatic scale which would produce the effects to

be found in the lunar photographs. Add to this the fact that almost every observer states, that upon clear nights and under favorable circumstances, they have detected decided green tints in the darker portions of those dark regions. Even Beer and Madler, who were almost bitterly opposed to Shroter's speculations as to the moon being inhabitable, testify, upon numerous occasions, to having received decided impressions of green from various portions of the dark regions.

Every landscape painter knows that all color fades into gray as the distance from the eye increases; consequently, it would be in exact accord with our experience if the local color of the moon failed to reach us; but as that color is of a nature which absorbs the actinic ray to a greater extent than it does the luminous, it tells us in very plain chemical language, that it is not what it seems. Hence, it is almost certain, that we have never seen the moon as it really is, and that therefore our assumptions as to its true character have all been premature.

As the creation of that body must have been coincident with and a part of that of our earth, it follows that we cannot rationally hope to solve the problems of this world without knowing more about that.

Here, then, we have an attendant planet constantly accompanying us in our wanderings through space, whose fate is identified with our own. Its distance from us is no greater than may be traveled by ordinary railroad time in seven or eight months; yet with the telescope in our possession capable of unlimited improvement, our knowledge of that kindred world is still about as dark as her own eclipse.

Binocular Telescope.

Mr. Charles B. Boyle, after reading his paper, exhibited an improved telescope for comet searching, having two eye pieces, each of which can be adjusted to a different focus, whereby double the field of an ordinary telescope is presented to the eyes of the observer.

Prof. J. A. Whitney, after a few appropriate remarks, moved that a vote of thanks be tendered to Mr. C. B. Boyle for his elaborate and interesting paper, and the beautiful model of the moon shown now and at the last meeting, which so clearly illustrated his remarks.

Mr. P. V. Hickey, after adding some further commendatory remarks, seconded the motion, which was carried unanimously.

May 20, 1869.

Prof. S. D. TILLMAN, in the chair; Mr. C. E. EMERY, Secretary.

RELATIVE VALUE OF THE SCREW AND PADDLE WHEEL.

Mr. J. K. Fisher stated he had seen an article in a daily paper of that day which appeared to him quite remarkable. A paddle-wheel steamer of 400 tons carrying capacity, burning eight tons of coal per day, and making seven and one-half knots per hour, was altered to a screw propeller, carrying 800 tons, and burning but four tons of coal per day; and yet making better time than when a side-wheel steamer. If this was a fact it was a very important one.

The Chairman thought there must be some error in the article referred to. A gain of about 100 per cent was not probable, especially as careful experiments have been made with the screw and the paddle wheel, and they were found to be about equal in efficiency.

Mr. Dudley Blanchard remarked that the paddle wheel has been agreed on as the best for smooth water. A line of screw steamers are now running from here to Boston. They have powerful and well built engines, yet they do not make any better time than paddle-wheel steamers.

SELF-CLOSING SAFETY HATCH.

Mr. George N. Creamer exhibited a model of his safety hatch. The principle on which the hatch works is gravity; and so perfectly are the weights operating it adjusted that, should a person, or even a weight of a few pounds, be upon the hatch, it will fail to open until the weight is removed, thus, as it will be seen, rendering it impossible for a person to be thrown down the hatchway by having the hatch jerked from under him while standing upon it. It can be operated from any floor above or below the hatch which is required to be operated on. When goods are passing through any one hatch all others above and below can be closed. Immediately upon the article of merchandise having passed, the hatch instantly closes of its own action, thereby receiving the goods, and saving the labor of from three to five men as in many instances. A person can stand on any floor and operate the hatch either from the top or the bottom. There are two ways of operating the hatch, either by treadle or cord. The hatch has been in use over a year. A five story building can be fitted with this hatch for $250, or fifty dollars a floor.

The Chairman remarked that this was a very important and ingenious invention. We have often heard of accidents to persons from the hatches now in use. But in the hatch here presented it seems these accidents cannot occur. Many of those present could doubtless remember when there was no other device in use for hoisting in warehouses but the ordinary tackle, and all the improvements in that line have been made within the last fifteen years. The invention of Mr. Creamer is an important improvement on those now in use, and should receive due consideration. A boy of ten years can work this hatch with ease, and it seems almost impossible for any one to get it out of order. This invention is a step in the proper direction. It is to secure safety when we are more or less in danger. All those operations which require heavy weights to be raised are attended with danger.

Dr. D. D. Parmelee said he thought this hatch one of those simple, practical, common sense devices that should commend itself to their earnest attention. It is a life-saving and a labor-saving machine. This is an important consideration in a city like this, where there are so many lives lost by the traps or hatches now in use.

Mr. J. K. Fisher remarked that we often hear of firemen falling through these traps, and he himself had often been in danger while going through buildings down town. If a good strong fence was placed around each hatch, it would save many accidents.

Vapor Stove.

Mr. D. H. Lowe exhibited a vapor stove, which is announced on his circular as "The greatest wonder of the nineteenth century!" The stove was set in action at the close of the lecture, and seemed to operate well, but elicited no discussion. To show that there was no danger of explosion, the exhibitor ignited the vapor at the top of the cistern of liquid fuel, and allowed it to flame up vigorously, a proceeding which, in this connection, indicated either great ignorance or consummate chicanery. It may be as well for the public, who are frequently solicited to purchase inflammable fluid, to know that vapor or gas will not explode until it is first mixed with a proper proportion of atmospheric air. Ether, burning-fluid, hydrogen, coal gas, and all inflammable gas and vapors, will burn quietly if they be not previously mixed with air, and the more vapor or gas present in a given space the more quietly will they burn. It seemed to be the opinion of the most experienced members of the Associa-

tion that while these vapor stoves are very valuable in careful hands, they are not fit to be entrusted to the hands of ordinary domestics.

Improved Method of Teaching Children and Foreigners to Read English.

Dr. Edward Leigh, of St. Louis, delivered a very interesting address, in which he gave an explanation of his Pronouncing Orthography, which is designed to facilitate the teaching of primary reading. It is not intended that this system shall take the place of the ordinary methods in our newspapers and general books. On the contrary, it is designed for use only in elementary reading books, and to aid the first steps of those who are learning to read the common English print. Dr. Leigh exhibited charts and phonotypic text, illustrating his method of phonetic teaching. This system, he said, was the result of years of toilsome labor, prosecuted under much discouragement, but with an earnestness of purpose which seems at last to have crowned his unwearying efforts with success. He taught his daughter from it in 1846, and originated the plan of the Boston Phonetic School, and aided in its establishment in 1850. Taught a class of illiterate adults in the St. Louis Evening Schools in 1859, yet utterly failed to obtain, at that time, a full and fair trial of his method in the Public Schools of Boston, though supported by the coöperation of some of the best and most influential teachers of that city. But the seed sown fell on good ground, and has borne much fruit.

The following examples will serve to illustrate and show the need and use of the reform he has introduced. The words *go*, *so*, *no*, are among the first that a child learns, and when he comes to the same letter *o* in *or*, *on*, *ox*, *to*, *do*, he naturally gives it the same sound of long *o*. In practice this is found to be the fact. Children usually call these words wrong at first, and pronounce *to*, *do*, like *toe*, *doe*, until the teacher corrects the error. The child soon finds that the letter is no guide to the sound, for *o* in the new word he meets may stand for any one of half dozen different sounds of the letter, as in *no*, *not*, *nor*, *wolf*, *move*, *love*, etc.; and there is nothing to tell him which it is. Discouraged by these seeming contradictions, he looks no longer at the letters of the printed word to tell him the sounds of the spoken word. He looks to the book, only for the form and appearance of the new word, just as he looks at any new animal, or fruit, or other object, whose name he wishes to learn, and then he

looks to his teacher's lips and listens to her voice for the name of this new printed form or word.

He learns every new word as a new and distinct object, in the same way that he learns the letters A, B, and C. He learns the words *bee*, *sea*, *eye*, *jay*, *owe*, *pea*, *are*, *tea*, *you*, in precisely the same way that he learned the letters *b*, *c*, *i*, *j*, *o*, *p*, *r*, *t*, *u*. Word by word, each word by itself, as a new and whole object, he learns our printed language, as a Chinaman learns his hieroglyphics, or as he himself had previously learned the spoken words.

With a pronouncing orthography, as with any regularly printed and truly alphabetical language, the case is wholly changed. Let *o*, or any other letter, have a special form appropriated to each of its sounds, and let each form be used regularly to denote only that one sound, and the form of the letter is a sure guide to the sound in every case where it occurs.

In the Primer, which Dr. Leigh exhibited, he said the pupil has learned the sounds and letters, and begun to apply this knowledge in the art of reading. He has acquired a vocabulary of easy words. He has begun to form habits of correct and distinct pronunciation, and of self-help and independence in study, and to train his eye and ear to observe peculiarities of letters and sounds, and to notice the difference between them.

In the Primary Reader, he will go on to use and apply his knowledge of the sounds and letters till he is skilled in the art of reading simple sentences. He will extend his vocabulary till it embraces most of the words used in primary books. But what is still more important, he will perfect and fix the good habits of speech, of study, and of observation, which he began to form in the Primer class. In this way much will be secured and saved that might soon be lost if this print were prematurely laid aside. The influence of street associations, and sometimes even of bad habits of speech at home, requires a longer and more presistent school influence to overcome and train the children, in spite of it, to habits of reading and speaking correctly. The transition to common print will be made by the pupil after completing the Primary Reader. It will, indeed, be found, on trial, that he is already able to recognize, in the ordinary print, most, perhaps all, of the words he has in this type; for they are substantially the same, even more alike than words in Italic or Roman print.

He may be taught to spell by letter, by any good method. From

this task he has been spared during his first steps; now he is better able to grapple with it, and even has the advantage of those who have learned in common print; for he has acquired that cultivation of the eye, and that proof-reader's and Latin scholar's habit of noticing the minute peculiarities of words and letters, which will make all his reading a most effective spelling lesson: for, however useful and needful the spelling-book may be, it is by observant reading that good spelling is acquired.

This system has been in actual use for about two years in St. Louis. All those provincialisms, improper pronunciations and indistinct articulations which are so prevalent in this section, especially among children whose parents are of foreign birth; all those vices of speech which cost the most persistent and long-continued drill to eradicate in after years, seem to be filtered out.

A good way to learn and teach the sounds is by such exercises as—

him m m m me | sun n n n not.

First say *him;* then, without opening or moving the lips, repeat *m* three times; then say *me*. So, repeat *n* three times without moving the tongue. Do the same with the other sounds; but for *b d j g*, *p t ch k*, *i oi ou u*, *er wh x*, the lips or tongue must move.

The sounds may be taught first in oral lessons, without using the letters; but it seems better to use eye and ear together from the very outset, and teach the sounds while pointing at the printed letters.

Do not practice sound lessons too long at a time, or in too loud a voice. Make them brief and frequent. With moderately loud tones, but a quick, lively, distinct utterance, the exact sounds will be better distinguished and acquired, and the vocal organs of both teacher and pupil will be, not strained, but strengthened and improved.

The words *the*, *a*, should never be pronounced alone, as separate words, but should always be taken in connection with the words to which they belong; as, *the man*, *a boy*, *the ox*. This will secure the proper sound, the light, brief sound, of these vowels. Special forms of letters are not needed for these, or the other brief, unaccented sounds, as b*e*lieve, r*e*ceive, *a*bility, c*a*pacity, sep*ar*a*te, t*o* be, t*o*-day, *o*'clock, &c.

Teach the pupil the difference between spelling by the names of the letters, and spelling by sound, but let him confine himself to the latter while using this book.

The natural order of the sounds, and not any arbitrary a b c, a e i o u, arrangement, has been kept in view in these exercises. Practising the sounds in pairs, and in their true order, as they are actually related in nature, will not only aid in acquiring the right sounds, but will give interest and life to the school exercises; for there is a real harmony in the vocal as well as in the musical scale, which at once strikes the ear and awakens the interest of the class.

Prof. James A. Whitney said he wished to express a very high opinion of the English language; it came from the stout old Saxon tongue, from Saxon men who built up the greatest civilization the world has known. And as the commerce of England extended, we took words from almost every language under the sun, even from the Sandwich Islands we have taken some. And what is called a fault in our language is an advantage, for we can express a thought in it much better than in any other that he knew of. He believed that all statesmen agree that the language of a people is a criterion of their greatness. An excellent feature of Dr. Leigh's system is the speedy eradication of provincialisms so prevalent among us. One great object which we should have in view, is to have our language taught homogeneously throughout the country. If the system of Dr. Leigh's could be used all over the country, it would take but one generation to wipe out the difference in language of foreigners, and their childern, and eradicate all difference in nationalities, and in time bring us to what we should be, a homogeneous nation.

Dr. Leigh remarked that Mr. Moeller, of the German school in Twenty-seventh street, in this city, taught a class already reading German for twenty minutes a day. He says that in three months they have gone through half the book, and it would require a very acute ear to hear the foreigner in the children. The results have been very satisfactory. In teaching German children to read and speak English correctly there is a great trouble, and sometimes it takes years with the old method.

The Chairman said that when the Pittmans first introduced their system of phonetics in this county, it failed on account of using a new style of spelling in our language. Dr. Leigh's spells the language correctly for his pupils; the words to be pronounced being printed in heavy letters, and the unpronounced letters in light lines. The whole system he said appeared to be the greatest improvement that has been made in this direction for years. It is shown by experiment that half the time in learning is saved by this method.

On motion of Prof. Whitney a vote of thanks was tendered to Dr. Leigh for his exposition of his improved method of teaching children to pronounce the English language.

Adjourned.

May 27, 1869.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The Chairman opened the proceedings by reading the following items of scientific news:

A Test for Glycerin.

The increased use of glycerin in the arts of late has, of course, brought into the market an adulterated article. When sugar and dextrine were mixed in small proportions with glycerin it has hitherto been difficult to detect the adulteration, but it is now easily done by the following method: To five drops of the glycerin to be tested, add 100 to 120 drops of water, one drop of pure nitric acid, and three to four centigrammes of ammonium molybdate, and boil the mixture, and in less than two minutes it will assume a deep blue color if any sugar or dextrine is present.

Action of Water on Lead.

Dr. Frankland of the London Royal Institution has found that soft water after passing through animal charcoal loses its power to act on lead, and this is owing to a minute quantity of phosphate of lime which passes from the charcoal into the water. The soft water of the river Vyrnwy, which does not act on lead, was found to contain an appreciable quantity of phosphate of lime.

Improved Electric Light.

F. P. Le Roux has utilized the immense heat of the voltaic arc by placing a cylinder of magnesia, prepared by the process of M. Caron, having a diameter of about eight millimeters between the charcoal points of an electric lamp. Thus the magnesia displays an incandescence equal to that of the most luminous portions of the charcoal.

To Remove Carbonic Acid from Wells.

A correspondent of The London Artisan gives an account of an ingeniously extemporized apparatus for removing carbonic acid from

a well, which consisted of a common umbrella inverted and so arranged as to be several times let down to the bottom of the well while closed, and rapidly drawn up while open. The effect was to remove the gas in a few minutes from a well which was so foul as to instantly extinguish a candle previous to the use of the umbrella.

Olegraphs.

This name has been applied to the beautiful figures formed when oil is allowed to fall, drop by drop on pure water, which Dr. Carter Moffat has succeeded in fixing on paper. The process consists simply in obtaining the pattern on water, noting the time, laying on the paper glazed side downward, for an instant, and then drawing it through a plate of ink, after which it is washed with water. The method of producing these figures on water was first fully described by Prof. Tomlinson of London, and published last year.

The Cypress of Somma.

This tree in Lombardy, Italy, is said to be the oldest tree in Europe. It is believed to have been in existence at the time of Julius Cæsar, forty-two years before Christ, and is therefore 1,911 years old. Napoleon, when devising his plan for a great road over the Simplon, diverged from a straight line to avoid injuring this tree. It is 106 feet high and twenty feet in circumference, or about one-third the size of the greatest trees in the Calaveras Grove in California.

Portable Illuminators.

M. Alvergniat, a French electrician, has made an improvement first suggested to him when using the tubes invented by Giessler, which are cylinders or bulbs of glass filled with rarified gas that becomes luminous in the dark when a current of electricity is passed through it. The improvement consists in filling a glass cylinder or or phial, hermetically sealed, with a substance which becomes phosphorescent by the action of frictional or static electricity. A tube of this kind may be of some service to those on night duty, for all that is requisite to produce a feeble and ephemeral light is to rub the tube briskly with a silk handkerchief.

Temperature of the Blood.

Dr. J. S. Lombard has applied his delicate thermo-electric apparatus to the study of the effects of respiration on the temperature of

the blood, and has found that very cold and dry air taken into the lungs does not lower the temperature of the blood sufficient to affect his apparatus, which will indicate any change of temperature exceeding 1-2,000 of a degree Centigrade ; and this may be accounted for by the fact that at low temperatures the air is more condensed and a larger portion of oxygen is inhaled, and by its conversion a larger amount of heat is generated.

This item elicited the following remarks:

Mr. Fisher.—The temperature of the extremities is often a great deal lower than the normal average temperature of the body, and in cold weather people often suffer from this cause.

Dr. Edwards.—The temperature of the body remains constant under all circumstances. The extremities may become cold, but the interior of the body always maintains an even temperature.

Mr. Emery.—Perhaps the facts stated by Dr. Tillman may be due to the circumstance that a pound of coal will evaporate more water; that is, it will make more steam on a cold day than on a warm one. This fact is pretty generally known to engineers.

Prof. Phin.—I doubt the fact stated by Mr. Emery. Every unit of heat added to the elements before combination serves to increase the ultimate result. If the air and coal were both heated to 200 degrees, they would make more steam than if they were brought together at a temperature of zero. The results obtained by the hot blast serve very fully to establish this.

Dr. Parmelee.—Is not all this due to the fact that during cold weather we are more active than we are during warm weather? During hot weather we get lazy ; at least, most of us do.

NATURE'S GOLD INGOT.

The greatest nugget of gold yet discovered is that lately found in Victoria, which is said to weigh 200 Troy pounds.

AKAZGIA.

This new alkaloid was found by Dr. Frazer, of Edinburgh, in specimens of the akazgia plant brought from the west coast of Africa, and which he supposed to be a new species of Strychnos. Akazgia is a crystalline alkaloid, closely resembling strychnia, but differing from it by being precipitated by alkaline bicarbonates. Travelers report that the natives of West Africa use Akazgia as an ordeal. A supposed sorcerer is compelled to drink an infusion of

the bark of this plant and walk over small akazgia sticks. If guilty, he tries in vain to pass the sticks and falls in convulsions, when he is beaten to death by the savages; but if innocent, the kidneys will act freely and the poision is thus eliminated. Dr. Frazer found certain twigs of the so-called akazgia of different structure, which did not yield the new alkaloid, and it is probable that those natives who have escaped from the ordeal, drank a decoction made from this variety.

PRESERVATION OF MARINE ANIMALS.

Mr. A. E. Verrill avers, in the American Naturalist, that he has successfully used glycerin for preserving marine animals, by which they retain their natural colors nearly as brilliant as in life. The only precaution necessary is to use very heavy glycerin, and to keep up the strength by transferring the specimens to new glycerin as soon as they have given out water enough to weaken the first, repeating the transfer two or three times, according to the size and number of the specimens, until all the water has been removed. The old glycerin can be used again for the first bath. In many cases the specimens, especially the crustacea, were killed by immersing them for a few minutes in strong alcohol, which aids greatly in the extraction of water, but usually turns the delicate kinds to an opaque, dull white color, but this opacity disappears when they are put in glycerin, and the real colors again appear. The green shades turn red almost instantly in alcohol, and specimens of this class should be put at once into glycerin.

CLIMATIC CHANGES PRODUCED BY TREES.

The British Medical Journal says the ground on which stands Ismailia, a town of 6,000 inhabitants, was but a few years since a dry, sandy desert, on which rain was never known to fall. All is now transformed. The old, dried up basin of Lake Timsah has been again filled with water from the Nile, by a fresh-water canal; trees, shrubs and plants of all descriptions grow rapidly wherever the soil is irrigated, and the artificial oasis widens fast. Accompanying this extraordinary transformation of the aspect of the place, there has been a corresponding change in the climate. At the present time Ismailia, during eight months in the year, is probably the healthiest spot in northern Egypt. The mean temperature from June to September is 94° F.; the four following months 74°, and the four win-

ter months 45°. Until two years ago, rain was unknown, but in twelve months, ending in April last, there were actually fourteen days on which rain fell, and lately there fell a tremendous shower of rain—a phenomenon which the oldest Arab had never previously witnessed. Rain ceases to fall on a country deprived of its forests, or only falls in violent storms. Here we see rain returning to the desert on restoring the trees.

This item called forth some discussion.

Dr. Edwards.—This is probably due to the fact that plants evaporate so much water, and this water returns in the form of rain.

Dr. Tillman.—And yet the ground under forests is invariably damp.

Mr. Phin.—It is not probable that the same water which is evaporated by the plants will return to the soil from which it was taken. The subject is one of great difficulty, and no theory that fully accounts for the phenomena has yet been propounded. It is not improbable that the trees act as lightning rods, and that the influence exerted in this way causes the rain to be precipitated.

WELLS DUG BY PRAIRIE DOGS.

Mr. G. M. Sternberg, in the American Naturalist, raises the question as to the manner in which the prairie dog obtains its supply of water. He does not accept the opinion expressed by General Marcy, in his "Army Life on the Border," that the animal does not require any more water than is contained in the grass roots on which it feeds. The prairie dog towns on the plains are often situated miles away from any water that can be discovered on the surface, and it is difficult to understand how sufficient moisture could be contained in the food of the prairie dog to replace what must be lost in respiration, &c., and to carry on the process of digestion during the months of September, October and November. At this season of the year it is not unusual for from fifty to sixty days to pass without a drop of rain falling. There is no dew, the air is extremely dry, and the short buffalo grass (often the only thing which grows on the highlands where the prairie dog villages are commonly found) becomes completely dried down to the roots, while the roots, being but two or three inches under ground, become hard and dry. As tame prairie dogs are frequently seen to drink water, Mr. Sternberg expresses the belief that in every prairie dog town there is a sufficient number of wells to supply the inhabitants with water. From attempts he had

made to flood certain holes, he concludes that the dogs would not, in some cases, burrow so deeply and so straight down with any other object than to obtain water. Such holes show signs of being constantly resorted to by the dogs, and do not have the appearance of being lived in by a family.

Mr. J. K. Fisher.—The late Mr. Fitz drank no water, tea, coffee or other liquid. Perkins used to say that if we did not eat salt we would not be required to drink water.

Professsor Phin.—Bread contains a good deal of free moisture, and, besides this, every pound of perfectly dry bread contains over half a pound of water in chemical combination with carbon.

Dr. D. D. Parmelee.—Does any one here know anything about these holes? It seems to me that we have not sufficient data to guide us in a discussion of the question. I cannot find out whether these holes are ten feet or thirty feet deep. Moreover, in what kind of soil are they dug? If the dogs dig through the sand to a stratum of clay at a depth of a few feet, they can probably find water very readily.

Steam Plow.

Judge Knapp, of Illinois, exhibited and explained a novel kind of steam plow, which was intended to be used on the large fields of the west, and the cost of which it was hoped would be such as to bring it within the reach of every extensive farmer.

In this apparatus the engine is placed upon a strong horizontal framework, furnished with four wheels, designed to support, but not propel, the machine. The plow is made double ended, or with two shares pointed in opposite directions, and is carried by the outer end of a rearwardly projecting arm. This arm is pivoted to the frame, and is worked by suitable mechanism connected with the engine in such manner that the plow will be moved to and fro in the arc of a circle, cutting a furrow at each movement in either direction. During a short furrow between the turning of each furrow and the succeeding one, the apparatus is moved forward the requisite width of the furrow by means of knee-jointed legs provided at the sides of the frame, and receiving an intermittent movement from suitable mechanism, driven like that which operates the plow, from the engine arranged upon the frame. The ingenuity and originality shown in the general design of the apparatus were commended, but the discussion was generally opposed to the inventor's claim with regard to the practical value of the machine.

The judge said he expected that this machine could be operated by an eight horse-power engine, so as to plow at a much less rate than the present cost of operating by horses or oxen, a thing which the expensive British steam plows have thus far failed to accomplish.

Mr. J. K. Fisher.—I deny that the British plows have proved a failure. The published reports show that they do the work at a greatly less cost per acre than is at present paid for the same work done by horses.

Judge Knapp.—Yes, but their great cost places them beyond the reach of all except dukes, earls, etc.

Mr. D. Blanchard.—It seems to me that when that plow moves it will have a tendency to move the whole machine sideways, and thus destroy its efficiency. The plow has a great leverage over the wheels, and, if it is moved with a pressure of 400 pounds, it will exert a force of several times that required to move the machine.

Judge Knapp.—The weight of the machine is so great that it will be almost impossible to move the wheels sideways.

Mr. C. E. Emery entered into an able and elaborate calculation, which went to show that the power stated by Judge Knapp was entirely below what would be requisite to operate the plow.

Origin of the Various Alphabetical Forms.

Dr. J. J. Edwards delivered a somewhat elaborate address descriptive of the manner in which the various letters of the different alphabets originated. The paper could not be made clear without the aid of engravings of the numerous drawings exhibited by the lecturer, of which no copy has been furnished for this report.

Adjourned.

June 3, 1869.

Prof. S. D. Tillman in the chair.

The Chairman presented the following notes on applied science:

Indigo.

M. Camille Kœchlin has discovered that indigo is soluble in alkaloid salts, and particularly in the acetates and chlorides of aniline, morphine, etc.

Crystals in Diamonds.

Mr. Sorby has proved that what were supposed by the late Sir David Brewster to be cavities in diamonds, are in reality crystals, and that the fine lines or cracks radiating from these crystals are the result of contraction. The same phenomena are seen when a fused globule of borax glass inclosing a crystal is allowed to cool slowly. This view leads us to the conclusion that such, and perhaps all, diamonds are formed at a high temperature.

Preservation of Hydriodic Acid.

This acid will be preserved in a white state by the presence of turnings of copper. The iodide of copper, which is very slowly formed, is not dissolved by the acid.

Aqua Regia and Metallic Sulphides.

Mr. Lefort finds that when aqua regia is placed in contact with sulphur, or with metallic ores containing sulphur, chloride of sulphur is first formed by the decomposition of the hydrochloric acid, but soon after the first compound is destroyed by the nitric acid, and chlorine gas is set free, while sulphuric acid is formed. The best proportions of the mixed acids for securing rapid decomposition of the sulphides is one part of hydrochloric acid with three parts of nitric acid; the reverse of these is ordinary aqua regia, which consists of three parts of hydrochloric and one of nitric acid.

Chemical Action Arrested by Pressure.

Mr. Cailletet has found that the strongest acids properly mixed with water cease to disengage hydrogen in the presence of iron, tin, zinc, aluminum or sulphureted hydrogen when in contact with sulphide of iron, provided a strong pressure is exerted within the retort containing these substances.

Mr. Phin.—It is my impression Mr. Chairman, that Mr. Cailletet has deceived himself in this case. I have frequently prepared hydrogen by the action of acid on zinc under comparatively strong pressure, say ten atmospheres; but the pressures employed by me were very low, when compared with those employed by an experimenter who reported the results of his investigations in one of the early volumes of the reports of the British Association for the Advancement of Science. He used zinc and sulphuric acid, and the pressures attained were very high; as high as he could get iron vessels to with-

stand. When operating in glass vessels we are apt to deceive ourselves from the fact that the pressure causes the bubbles of gas to diminish in size, and we are apt to suppose that no action is going on; when, in reality, gas is being produced at a very rapid rate.

Sodium for Matches.

Dr. H. Fleck, of Dresden, has made a series of experiments with a view to obtain a substitute for phosphorus in friction matches, and finally made a mixture having the requisite qualities, which contains of the metal, sodium, 4.65 per cent; nitrate of potash, 61.39 per cent and black sulphuret of antimony, 33.96 per cent. This mixture must be kept thoroughly dry during its manufacture. The process is as follows: Pure solid paraffine is first melted in a glass-stoppered glass flask over a sand bath; clean pieces of sodium are then added, and melted under the paraffine. The flask is then closed and shaken for about ten minutes, which reduces the metal to a fine powder. On taking out the metal with a clean spoon, about thirty to thirty-five per cent of paraffine adheres to it, but does not impair its inflammability. The saltpeter and sulphide of antimony are separately mixed in petroleum, and pulverized, and are then incorporated with the sodium, under petroleum, in a metallic mortar. Instead of gum or glue, India-rubber, previously soaked in light petroleum at 110 degrees C. (230 degrees F.) for ten or twelve hours, is used as a mass to form an adhensive paste with the other materials.

Prof. Phin.—I read the account of these matches in the Chemical News, and I confess that I was very much surprised that a journal of such high pretensions should have published such an article without a word of comment. Moreover, the same paragraph has been copied in almost all our scientific papers, and thus far the manufacturer and builder is the only one that has appended a caution to the announcement. I regard these matches as one of the most dangerous of devices. They ignite by being moistened. Suppose a man were to put a few of these matches into his pocket and then perspire freely, what would be the result? A child applies one to its lips or touches it with a moistened finger and gets dangerously burned, for we all know the severe character of the burns produced by ignited caustic alkali, the *lapis infernalis*, infernal stone, of the old physicians. If a child should by chance swallow the tip of one of these matches, the consequences would be fearful. It is not improbable that a hole would be burnt in the coat of the stomach. These matches are similar to the

Devil's tears, which were sold as toys a few years ago, and certainly it is surprising that any sensible man should recommend them for an article of such common use as matches.

Cement to Resist a Red Heat and Boiling Water.

A German journal gives two processes for making these cements: 1st. To four or five parts of clay, thoroughly dried and pulverized, add two parts of iron filings free from oxyd, one part of peroxyd of manganese, one-half part of common salt and one-half of borax. These are rubbed together and made as fine as possible, after which water enough is added to make a thick paste. It must be applied immediately and then gradually heated almost to a white heat. 2d. To equal parts of sifted peroxyd of manganese and well pulverized oxyd of zinc, add a sufficient quantity of silicate of soda (water glass) to form a thin paste. The mixture should also be used immediately. It forms a cement quite as hard and durable as that obtained by the first method.

When to Sweeten Tarts.

Dr. Letheby, in his lectures on food, states that common cane-sugar is adulterated in Europe by means of starch-sugar or even starch itself. Starch-sugar, or as it is sometimes called grape-sugar, or glucose, has a low sweetening power; not half so great as that of cane-sugar, in fact, it is produced from the the latter by the action of vegetable acids and heat, when cane-sugar is added to fruit in making a tart or fruit pie, and in making jellies and jams. It is false economy, therefore, to sweeten to any extent before the tart is baked. Some American housewives have discovered, by practice, in making rhubarb pies, which requires a large amount of the sweetening principle, that a given quantity of sugar will be most effective when the largest portion is applied to the pie after it has been taken from the oven.

Purgueira.

The oil known among the Portuguese by this name has recently been subjected to experiments by Bouis. It contains about six per cent of nitrogen, which, on distillation, is evolved as ammonia. As it possesses some of the properties of castor oil, and is obtained, like the latter, from a plant belonging to the sponge family (*euphorbiaceæ*) he was led to distill it with an alkali, and the result of a saponification and distillation was an inflammable complex liquid having

an aromatic odor. The portion passing off between 170 degrees and 180 degrees C., has the same composition as caprylic alcohol, which is found in castor oil. The plant yielding purgueira was described by Adamson more than a century ago, under the name of *Curcas purgans*. It abounds in some portions of Africa and in the Cape de Verde islands.

NEW AND GIGANTIC PLANT.

The London Builder, of March 6, states that within the last few days living specimens have been forwarded to England, from Nicaragua, of one of the most gigantic plants of the vegetable kingdom. It is closely allied to the Arums (or "Lords and Ladies") of the hedges, and until the present time has wholly escaped the notice of traveling botanists. It produces but one leaf, nearly fourteen feet in length, supported by a stalk ten feet long. The stem of the flower is a foot in circumference, the spathe or flower is two feet long, purplish blue in color, with a powerful carrion-like odor. As this remarkable feature of Aroidæ is quite new to science, it has not yet received a name. A correspondent of The Builder describes the Arum found on the Campagna of Rome which bears deeply serrated leaves about the size of the human hand, but in other respects resembles the Nicaraguan plant. It has a purple spathe about eighteen inches in length and the flower has the same repulsive odor.

FIBRIN OF BLOOD.

Messrs. Bechamp and Estor maintain that the so-called fibrin of blood is only a kind of membrane formed by the mycrozymas, associated with a substance secreted by them by means of the albumenoid substance of the blood.

SUN DIALS.

A correspondent of The Builder says whoever can project the simplest constructions the carpenter requires in solid geometry, those for a high rafter, for instance, may readily construct any kind of sun dial whatever, for any latitude, on being simply informed of these two invariable rules:

1. The shadow casting edge is a straight line, and must always, everywhere and in whatever form of dial, be parallel to the earth's axis. Consequently all the true gnomons are parallel; with one varying from their direction no true dial could be made, but its time would vary every day in the year.

2. The hour lines, on whatever surface, plane or not, are the intersections of that surface by planes, all meeting at the shadow casting edge, and making equal angles thereat. Consequently having found the twelve o'clock plane (which is the meridian), the eleven and one one o'clock planes must be inclined thereto fifteen degrees, and the ten and two o'clock thirty degrees, and so on; their common intersection being the gnomon edge.

Most persons probably know that the theoretic sun dial is not, except on four days of the year, the true clock time of the place. The *minutes* of the equation of time for any day are generally the same for every year, but not the *seconds;* and the four times of no equation, or of maximum equation, may each fall, in different years, on the former or the latter of two days (just as the equinoxes may). The only reason the same table will not serve for two successive years is the excess of the year over the exact number of days. Thus 1868, being a leap year, was above eighteen hours longer than a true year, while 1869 is to be nearly six hours less than a true one. If the excess were an exact quarter of a day, this table would be the same for any year as for the fourth before or after it; and four tables would serve by turns continually. But the defect of the fraction from six hours prevents this, and makes another gradual accumulation of differences, to the table of two dates ninety-six years apart differ nearly as much as two successive years. This again, in our present Gregorian style, is over corrected by one day omitted from the centurial year; and yet again under corrected by the retention of the day in the 400th year; and thus it happens that, practically, while the world stands, each year must have its own table. In astronomical books, however, we see a practically permanent "equation of time" table made by omitting days of the month and substituting the sun's longitude. We may also regard it as dependent on the sun's declination only in this way. He crosses any given delineation circle twice a year, and to each delineation belong no more than two amounts of dial correction in going southward, the other when he passes it in coming northward. To each tropic, however, and to one intermediate circle, about ten degrees north there belongs only one dial error. Hence the mediævals got a simple and elegant way of setting their clocks. In some Italian cathedrals the transept has a meridian line marked on the pavement, and a lens in the south window, casts an image of the sun, whose center, of course, crosses this line every day at dial noon; but farther north or south each day as his

declination varies. But the mediæval architects did not stop here. They found out how to so construct another line, a most difficult curve, lying half east and half west of the straight one, that the sun's image crosses this curve every day at twelve o'clock noon. This curve, resembling a very lengthened figure of S, is called the *analemma*. We may see it drawn now, on a small scale, but never well, on the vacant part of the ocean of some terrestrial globes, its lower or big loop standing on the south tropic, and its lesser loop reaching the northern. If correctly drawn, the resemblance to an italic 8 would be so complete that it would lean a little from the meridian. This figure then served (as it might again) all the purposes of our "equation of time" tables. Few people know that the two maximum errors, which occur in November and February, when the clock is farthest behind and before the sun, are not equal. One is nearly seventeen minutes and the other is barely sixteen. Now, this arises from the italic leaning of the 8, and is increasing and will increase for many centuries to come. But about A. D. 1250 (from which date our globe-makers would seem to take their *analemma* unchanged, though the loops were more unequal than now, the eight was upright. Before 1250, it had leaned the other way ever since Adam's time. But about his time it was not only upright, but the loops, instead of their being at their greatest inequality (as in 1250), were equal; as they became only once in about 13,000 years. Throughout these 13,000 years the southern loop continues the biggest; and then, for another 13,000 years the northern will be the biggest, and the present changes will be repeated inversely. Thus the astronomer's tables, that substitute the sun's longitude for months and days, although called "practically" permanent, do not serve forever.

In connection with this item on "sun dials," Mr. C. F. Boyle remarked that the main difficulty with the correctness of the sun dial is the difference of the refraction of the sun light at different parts of the year. For instance, on a winter's day the light striking obliquely there is more refraction, and hence the indications are different in winter from what they are in summer.

HELIOTELLUS.

Mr. Henry Whitall exhibited a Heliotellus, invented by Prof. J. Davis. This instrument contains five globular bodies, which, by their arrangement, relations, and motions, exhibit the arrangement, relations and motions of the Sun, Mercury, Venus, Earth, and the

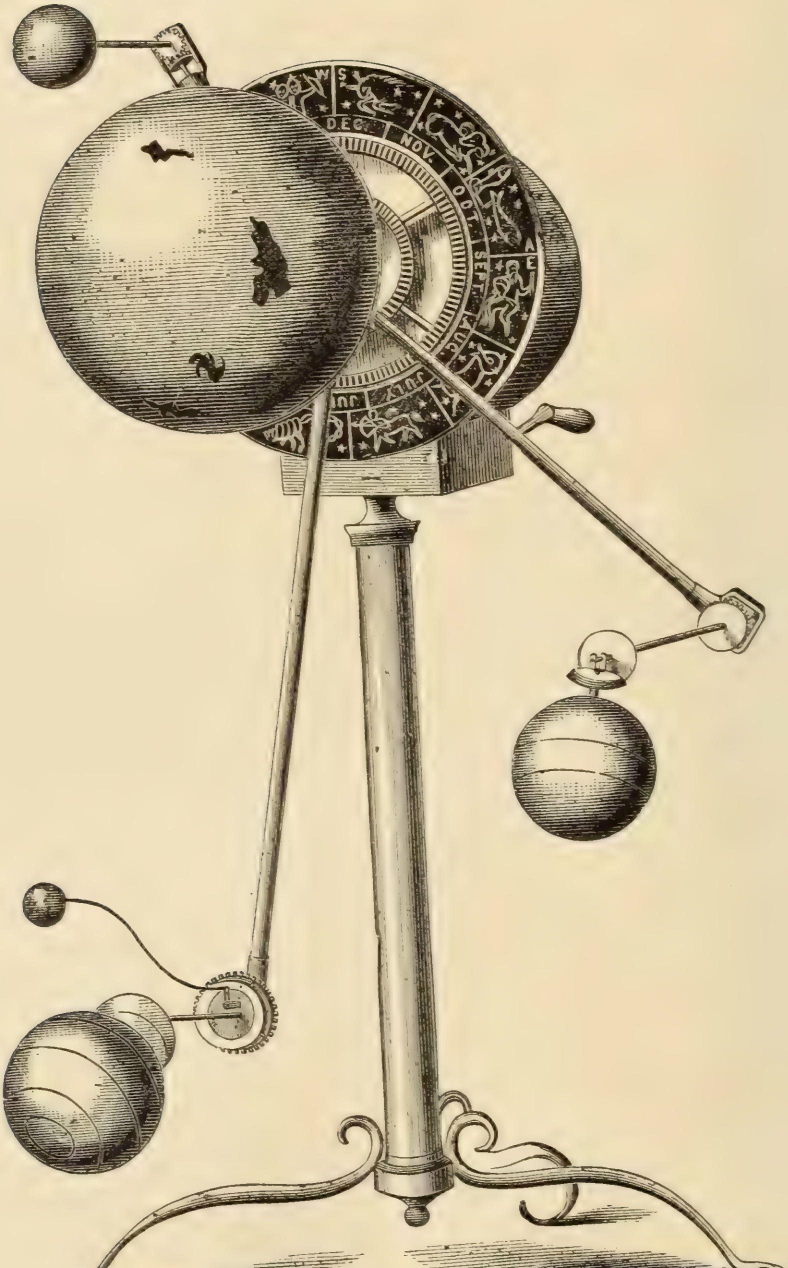


Fig. 2.—Heliotellus.

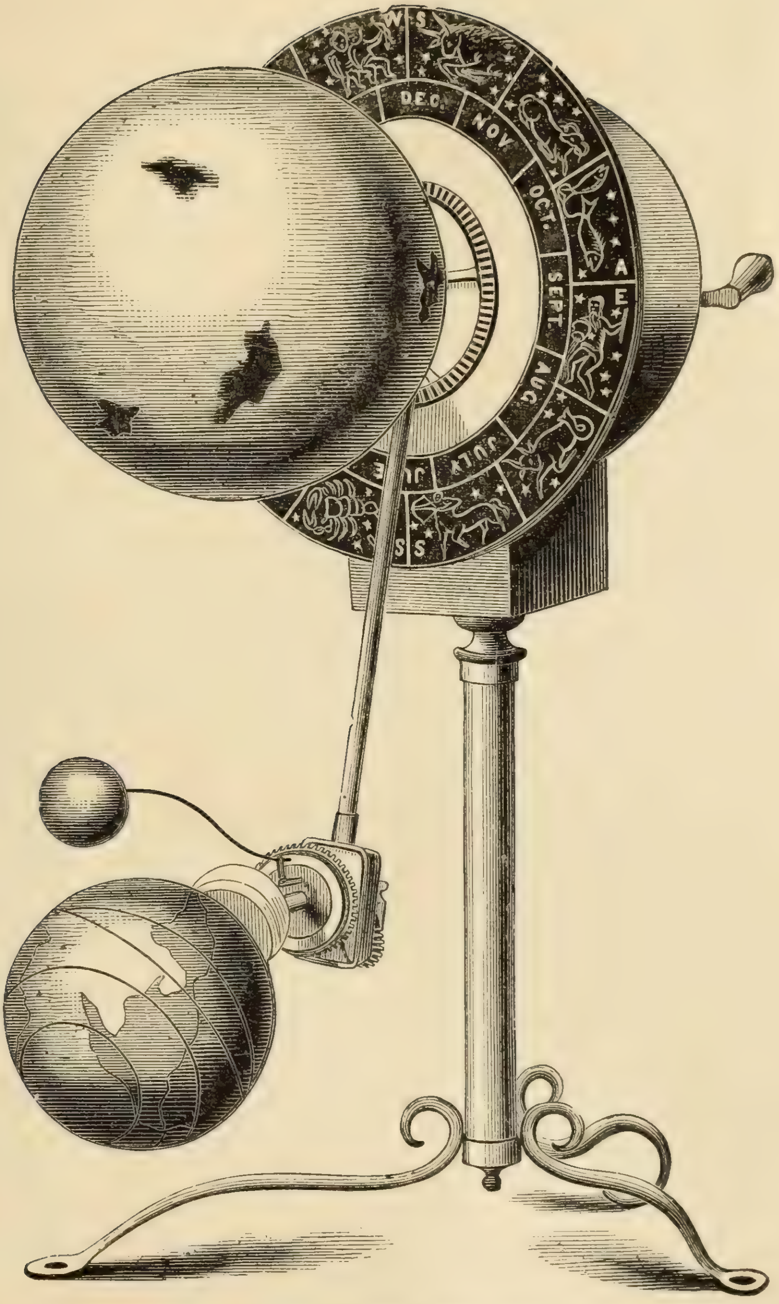


Fig. 3.—Large Lunatellus.

Moon, as so many parts of the solar system. It represents the motion of the sun on his axis; the relative yearly motions of Mercury, Venus and earth; also their relative daily motions, and the motions of the moon around the earth, around the sun, and on her axis. It shows the inclination of the axes of Venus and the earth to the planes of their orbits, and illustrates the respective widths of their different zones; the succession and duration of their different seasons; the different lengths of their days and nights; the amount of change of the sun's declination in relation to each, and his rising and setting on each; the superior and inferior conjunctions and phases of Mercury and Venus, also the solar and lunar eclipses; the length of lunar days and nights; the retrogression of the moon's nodes, and the changes, phases, and fulling of the moon.

By the use of the Heliotellus and the artificial zodiac connected therewith, these phenomena, the tides also, and other elements of useful knowledge, can be explained with such clearness and simplicity that even a child, with little attention, cannot fail to comprehend them. This instrument, for the purpose of illustrating a portion of the planetary system and the phenomena resulting therefrom, is invaluable; and as it can be carried in the hand, and occupies but little space, economizes the time and expense of the pupil, and diminishes the labor of the teacher. The price of this instrument is forty dollars.

Lunatellus.

Mr. Whitall also exhibited a Lunatellus, which illustrates the astronomical phenomena of the sun, earth and moon in their natural order; with the geography of the earth in its proper relation to them. The sun is made to turn on his axis; the earth revolves at her proper inclination on her axis and around the sun, producing not only the change of seasons, and the vicissitudes of day and night, but also their natural increase and decrease in length. The moon revolves around the sun on her axis, and around the earth, producing the alternation of her days and nights; her changes, phases and fulling, and also by her retrograding at every revolution and the interesting phenomena of solar and lunar eclipses. And as the natural divisions of the surface of the earth, and political divisions of every country are marked on the body that is employed to represent the earth, the geographical and astronomical relations of every locality, at any particular period during the year, are clearly exhibited to the eye. This instrument is sold at sixty dollars.

POSITIVE MOTION LOOM.

Mr. James Lyall exhibited a model of his positive motion loom. The most striking feature of it is that the *picking stick* heretofore of universal use is entirely dispensed with. The *shuttle being carried through the warp* is, with all other parts of the loom, held and entirely controlled by a direct and continuous connection with the motive power; hence the liability of a "smash" is totally removed, and no injury can happen to the reed. In case of the loom being stopped during the passage of the shuttle, or at any other time, each part is in place for starting again. The advantages of this loom over others are:

1st. The unlimited scope of the shuttle; it being carried instead of knocked through the warps, enables the carrying of large quantities of weft any distance. 2d. The friction of the shuttle on the yarn is wholly overcome, therefore, the shuttle does not wear the warps, nor break any threads, even in the finest fabrics of silk, wool, cotton or linen. 3d. The weft is not subject to sudden pulls in starting, hence, may be of the most delicate texture, regardless of the width of the fabrics. 4th. The reed moves but a little distance and wears less on the warp. 5th. The heddles do not require to be opened as wide as usual, thus avoiding much of the strain on the warp. 6th. The width of the fabric may be extended indefinitely. 7th. The loom runs with less power, much more quietly than other looms, and at any speed desirable. Mr. Lyall further remarked that he had in practical operation the largest power loom in the world, run by steam power, weaving goods six yards in width. One girl takes the place of ten men, she can attend to five looms.

Mr. Dudley Blanchard said this was one of the most important inventions he had yet seen. The improvement here shown has been long sought after. He, himself, had tried his inventive powers to make something that would accomplish this result, but could not succeed.

Drs. J. V. C. Smith, J. J. Edwards and Mr. Lambert, spoke in the highest terms of the importance of this invention.

SELF-RIGHTING LIFE BOAT.

Mr. Charles Gunner exhibited a model of Gunner & Peterson's Universal Self-righting Life Boat. He said that it is not a new thing for boats to right themselves; there are many built that will right when empty, but not when freighted. He claimed that his

boat would right itself under any and all circumstances. The keel in this boat is, as it were the back bone from which starts the ribs. The loose keel lies under the true keel, and is bolted to it between the bow and stern, it projects about six inches beyond the sides of the true keel, and is called the keel water regulator. Should the boat cross the seaway this keel will prevent the drifting and canting of the boat, and will keep it in the right direction. This keel answers for the heavy keel and the water ballast, because it lies so deep in the water; it also gives great protection to the principal keel. The room which in other life boats is used for air-chests, is used in this boat for cabins. The great advantages which these cabins possess for those on board, are, that it is impossible for the sailors to disturb them, and again that, they cannot by seizing the side of the boat prevent it from righting; this safety is rendered surer, from the fact that every one will be strapped to their seats, and the saved will, by their weight, be the very best ballast, and the greater their number the better. The water holes are placed on the sides, and so arranged that the water on going in on the lee side runs out on the other. The weight of the boat is only 2,500 pounds; it is thirty-two feet long, ten feet four inches broad and four feet deep in the water, and accommodates about forty passengers.

After some discussion of the invention the Association adjourned.

June 10, 1869.

Prof. S. D. Tillman, in the chair; Mr C. E. Emery, Secretary.

The chairman read his usual weekly summary of scientific news, of which no report has been furnished. One item on "Molecules in Gamboge," called forth the following remarks by Dr. Vanderweyde:

The microscope, he said, was unable to show us any molecules; the largest are far beyond the power of the strongest microscope. It is said that the molecules of ice are in a state of vibration; that, at a low temperature, the hypothesis is that the molecules of hydrogen and oxygen are simply in solution, and that motion is the latent heat, and that we can get all that heat by freezing. And further, the hypothesis goes that the attraction between these is change of heat, and there is a to and fro motion in the solution; but with gases the molecules are rotating in space, not like the molecules rolling around each other. If small pieces of camphor are placed in water, they

will have motion, and travel in a circle, but, when a knife or other article is placed in the water, the motion of the particles of camphor will stop.

The Chairman alluded to the theory of motion of Prof. H. F. Walling, a member of the association, and published in our Transactions for 1866–7, in which a molecular theory is fully and ably set forth.

Temperature in Deep Water.

Dr. Vanderweyde remarked that he had invented a pyrometer on a principle nearly the same as that mentioned in the item just read by the Chairman. A tubular metallic stem inclosed a rod of another metal, and had at one end a bulb to contain a ratchet wheel and pointer. The greater expansion of the rod caused a pawl to turn the pointer to indicate the degree of heat. The apparatus was not approved on trial, because, after being subjected to a high heat, the parts failed to resume their original position, the instrument being thus rendered worthless. A lower temperature of the air will conduct more electricity than if the temperature is higher. To test the temperature of deep water, a galvanic battery and a galvanometer are the best instruments to use.

Prof. Phin referred to the well known Brequet thermometer, composed of annular or curved strips of metal riveted together in such a way that the differeuce of expansion in the two strips, by varying the curvature of the device, indicates the degree of change in the temperature.

The Chairman remarked that this thermometer was found not reliable in practice; but a device having two straight rods or plates of metal might be made to answer the purpose, appliances being used to obviate interference from increased pressure of the water at great depths, and also to register the change of temperature as indicated by the difference of expansion of the two parts; but all thermometers made of solid metal undergo certain changes, so that their graduation must be readjusted from time to time.

Dr. J. F. Boynton stated that about fifteen years ago he devised an apparatus for this purpose. It was composed of an acorn-shaped shell, provided with a pressure gauge recording up to 600 pounds per square inch, and designed to register the pressure at the depth of the sounding. This gauge was connected with mechanism inclosed within the shell, to which an electic wire was attached extending to the surface; this wire being so arranged in relation with the ratchet-

wheel and pawl of an index finger and plate, that the automatic opening and closing of the circuit by the mechanism of the gauge, caused the index to indicate accurately the degree of pressure. A registering thermometer, also inclosed within the shell, was used to ascertain the temperature. This apparatus he tried in the bay of New London, and it measured very accurately. We found sixty-seven feet of water there, which surprised several captains of vessels to whom he mentioned the result.

Prof. J. A. Whitney said that an invention for deep sea sounding was lately brought out in England, in which the temperature is ascertained by the varying resistance of metals to electrical currents at different temperatures; the increased resistance of the submerged wires indicating a proportionate rise in the temperature, and the greater resistance being made apparent through the agency of a suitable galvanometer. This appears to be a very accurate instrument.

ANTI-FRICTION VALVE.

Mr. W. Thilmany exhibited an anti-friction balance valve. A brief discussion ensued, during which Mr. C. E. Emery stated that the device was not novel.

MANUFACTURE OF NITRIC ACID.

Dr. Isidor Walz explained his new method of manufacturing nitric acid and soda from nitrate of soda or Chili saltpetre. It consists in heating carbonate of lime and Chili nitre in retorts, into which steam is at the same time admitted. The chemical reaction taking place is expressed by the formula: $Ca\,O, C\,O_2^2 + Na\,O, N\,O^5 + H\,O = Ca\,O + Na\,O, C\,O^2 + N\,O^5, H\,O$. The nitric acid is not split up, as it would be without the presence of steam, into oxygen and hypo-nitric acid, entailing the loss of from one-third to one-half the quantity present, but distills over pure, is condensed in Wolfe's bottles, and afterward concentrated. In this way nearly the whole theoretical quantity can be recovered. A nitrated mass is left in the retorts, consisting of caustic lime and carbonate of soda. This may be sold directly to manufacturers of soap and others, or it may be worked up in the factory, yielding carbonate of soda when leached with cold, and caustic soda when leached with hot water. The advantages claimed are greater purity of the articles, especially of the acid, simplicity of manipulations and processes involved, and cheapness.

AMERICAN METHODS OF TRANSMITTING MECHANICAL POWER.

Mr. F. W. Bacon, of Jersey City, read portions of an elaborate paper on the transmission of power at a high speed by belts, generally adopted in American shops in contradistinction to the slow motion and gearing used in similar establishments abroad. After giving rules for the calculation of width, speed, etc., the writer proceeded to consider the causes that impair the efficiency of belts after their proper selection and fitting to the pulleys. Among these were mentioned the common one of stretching; the liability of shafts to be sprung out of line, resulting in the running off of the belt at one side of the pulley; the coming of the belt in contact with another, thus producing abrasion and loss of power; the drying of the belt, and consequent diminution of adhesion and loss of power. Attention to points like these is of course essential, even when the utmost care has been exercised in adapting the belts to use.

The writer advocated the softening of new belts by the use of appropriate unctuous substances, by which they will be enabled to come in more immediate contact with the pulleys. He stated that under a comparatively high temperature, say 65° to 75°, as in summer, he had found a dressing composed of equal parts of tallow and castor-oil to be superior. For lower temperature, the proportion of oil may be increased, while during the heat of summer the oil alone may be used. Furthermore, when once treated with castor-oil neither mice nor other vermin will attack the belt.

The writer also spoke of the desirability, when crossed belts must of necessity be used, of crossing the subordinate instead of the principal belts, as by this means the minimum loss of power from the friction of the belt may be obtained. There are many cases in which shafts cannot be placed parallel with each other, and, aside from the use of bevel or skew gearing, there lies only the choice between the use of universal joints and crossed belts. The universal joint is not open to the objection of percussion, but the movement communicated thereby is not uniform, and, moreover, the centrifugal force throws off the oil, so that at high speed the requisite lubrication cannot be obtained. The use of crossed belts is not open to these drawbacks; but when these are used, the speed should be as great as circumstances may permit, in order to enable the belt to be had as narrow as possible, to facilitate its action despite the crossing of the same. In those instances where the width of the belt cannot be reduced to the desired degree, the writer advocated the placing of a supplemental

belt over the first, for the purpose of securing the advantages of a double belt without its rigidity. He also stated that by running the belt with the grain side in contact with the pulley a gain of thirty per cent is insured as compared with the result when the flesh side is placed innermost; and, furthermore, that by covering the pulley with leather, grain side outermost, so that grain side will be presented to grain side, the adhension will be fifty per cent greater than with the same belt run upon a smooth iron pulley.

With reference to the evolution of electricity from running belts, the writer mentioned a case that had once fallen under his observation, that of a main belt which passed over two pair of looms in a cotton weaving room. If a thread broke, its end would point up to the belt, and, if long enough, it would come in contract therewith. The hair of the attendants was made to stand on end by the same agency. The annoyance was so great that it became difficult to get the hands to attend the looms, but it was finally overcome by arranging, contiguous to the belt, an iron rod furnished with points and connected by a suitable conductor with a water reservoir. This carried away the electricity, and obviated the difficulty.

Previous to adjournment for the summer, Prof. J. A. Whitney rose and said that while, under all circumstances, he liked to address the Chairman, yet, on the present occasion, he would be pleased if he would vacate the chair for a few moments, while he made a few remarks which he knew would please every person in the room.

Prof. Tillman then left the chair, and Dr. L. Bradley was selected to preside.

Prof. Whitney continued: He said it seemed to him, and no doubt to the whole meeting, a source of regret that this was the last summer meeting of the Polytechnic Association, as they were about taking their usual recess. They had spent many pleasant evenings together, which had been to all of them both instructive and profitable. Their regret at parting is tinged with a deeper hue when they reflected that two of their members had left them, and would never be with them again. Their voices, which they were so pleased to hear, have been forever hushed; they are missed in their accustomed places, and they are often recalled to memory during the discussions.

The new ideas and facts that have been presented at the weekly meetings of the Polytechnics, and stored up in the mind from time to time, would cause them to remember the evenings they had spent together through life.

Among the pleasures which he received at the meetings, and which he felt more deeply than any other, was the recollection of the manner in which the association was presided over by their Chairman for the last year, and he might say for several years past. There are few persons who can appreciate the toils and strain upon the temper and on the mind that is always called forth from discharging a duty like that. And feeling sensible of the arduous position he has so ably filled, and the study and research required to collate the interesting scientific facts that are presented at almost every meeting, and which have elicited so many important discussions, and the thousand ways in which he has endeavored to make the meetings of the Polytechnic pleasing and instructive, all deserve from us some recognition for those invaluable services. He would, therefore, move that the thanks of the association be tendered to Prof. Tillman for the able and dignified manner in which he has presided over them. And he hoped that many years would elapse before they would miss his genial face at their meetings.

Dr. Dubois D. Parmelee seconded the motion.

Dr. J. J. Edwards said that for fifty years he had mixed with societies like the Polytechnic, and during that time he never knew but one man who possessed so many qualities requisite for the position which their honored Chairman held. The acumen and discrimination which he has shown during their discussions was highly commendable. Since the time of John Lettsom, he had not seen a man who held his own opinions, and yet gave every one else a chance to express theirs. As an old man he could not help rising and expressing his humble meed of praise of one who was so deserving.

Dr. L. Bradley remarked that for himself he most heartly concurred with the sentiments just expressed. Their meetings were presided over with dignity and ability, and he might say that the success of the Polytechnic was mainly due to the zeal and perseverance of their worthy Chairman.

The resolution was adopted unanimously.

Prof. Tillman expressed his warmest thanks to the members for this kind expression of their feelings. He would say with all candor that the success of the Polytechnic is chiefly due to the ability and practical knowledge found among its members. He belonged to several societies organized for scientific purposes, but had seldom met with a body of men who could speak so freely and yet profoundly on science, in the abstract, as well as in its application to

the useful arts. He concluded by saying he should always feel a deep interest in the future success of the gentlemen who had done so much to advance the interests of this branch of the American Institute.

The Association then adjourned to meet on the second Thursday of October next.

October 14, 1869.

Samuel D. Tillman, LL. D., in the chair: C. E. Emery, Esq., Secretary.

The Chairman, after welcoming the members to their accustomed places at the first fall meeting, presented the following scientific memoranda:

New Color Test for Blood.

The London Lancet states, on the authority of Prof. Bloxam, of King's College, that a mixture of tincture of guaiacum and a solution of peroxyd of hydrogen in ether instantly produces with blood or blood-stains a beautiful blue tint. He had extracted a single linen fiber in the sample of a blood-stain twenty-years old, and with an almost inappreciable amount of stain on it; and he found the characteristic blue color was immediately induced by the test, and readily detected by microscopical examination.

Pocket Spectroscope.

The new optical glass of great density, made by Messrs. Chance of London, has been used for four of the ten prisms contained in a direct vision spectroscope, which is small enough to be carried in the pocket, yet so powerful that it shows the D lines of the spectrum widely separated.

Singular Molecular Change.

While making some experiments on heating strained iron wire to redness, by means of electricity, Mr. Gore observed that after disconnecting the battery, and during the process of cooling, the wire suddenly elongated, and then gradually shortened until quite cold. A number of experiments were made with wires of different metals and alloys, but in no other case was a similar change detected. The amount of elongation in the iron wire was found to be about 1-240th part of its length. During the process of heating the wire, no

increased elongation was observed at any particular temperature, therefore the diminution of cohesion seems to depend not only on temperature and strain, but on the condition of cooling. It would be interesting to the engineer to know whether many repetitions of this process impaired the quality of the iron.

Climate Influenced by Drainage.

Prof. Ballot, Director of the Netherlands Meteorological Institute at Utrecht, states that the draining of the Haarlem lake, in Holland, a surface of 19,000 hectares (about 46,951 acres), has had the effect of increasing the average summer temperature of that locality, and the adjacent country, by one-half a degree Centigrade, and of decreasing the average winter temperature one-half a degree.

To Preserve Meat in Hot Weather.

M. Guignet states in Les Mondes that butcher's meat may be preserved in hot weather by placing it in large earthern jars, putting clean heavy stones upon it, and covering it with skim milk. The milk will become sour, of course, but may afterward serve as food for pigs, and the meat will be found to have kept its natural primative freshness, even after eight or ten days.

The Cultivation of Truffles.

A French journal gives a long account of the cultivation of truffles, and the analysis of twenty-four different kinds of soil in which these cryprogamics grow, which, however, do not show that any particular composition of soil is specially adapted to their cultivation, although it appears that they flourish in those parts of France which are noted for producing good wine. The paper states that truffles were largely cultivated in that country for the use of the ancient Romans in the time of Cicero. Truffles, although the common kinds are indigenous in Pennsylvania and North Carolina, have been but little cultivated in this country. To produce the best varieties, even more care is required in the preparation of the soil than for raising mushrooms, which belong to the same family of plants.

The Respiration of Aquatic Plants.

Experiments made by M. Deheran show that aquatic plants, when kept in darkness, are asphyxiated, and on examining the water in which they died he found no trace of oxygen, but only carbonic acid

and nitrogen. In a small pond where a dense growth of *Lemna minor* had been allowed to accumulate, and which under the influence of light decomposed the carbonic acid of the air and furnished oxygen to the fish, it was found on excluding the light that both fish and plants were killed. A distinguished French botanist, M. Van Tieghem, has also made some interesting experiments with aquatic plants. He found that, although direct sunlight only is competent to start the decomposition of carbonic acid by the chlorophyl of the leaf, the plant continued to exert chemical action for three hours after direct sunlight had been withdrawn, and for nine hours in diffused daylight instead of darkness. From this he infers that the vibrations induced by the luminiferous ether, or, in other words, by sunlight, are continued in the chlorophyl after the withdrawal of the direct rays, exciting a condition resembling that of solar phosphorence in a solid, for instance, that of a diamond, which, after being exposed to the direct rays of the sun, will emit a feeble light in the dark; and that this action of the chlorophyl, when once commenced, may be kept up by the modified motion of diffused daylight. The reasoning of this botanist is plausible, but his premises are defective, since plants will grow in aquariums which only receive the influence of diffused daylight.

Electricity, Return to the Old Theory.

Mr. Edward E. Quimby, of this city, has published a very able defense of Dr. Franklin's theory of static electricity, which attributes this class of phenomena to an excess or a deficiency of a single highly attenuated fluid permeating all ponderable matter. Objections early made to this theory gave rise to the hypothesis of two subtle fluids, which was generally accepted by European electricians, but which involves objections quite as serious as those it was intended to obviate. Not many years since scientists ascribed certain classes of phenomena solely to the presence of different kinds of subtle matter, and, at one period, not less than six distinct "imponderable fluids" were required to account for light, heat, electricity, magnetism and gravitation. After the experiments of Fresnel had confirmed Huyghen's theory of light. Newton's corpuscular theory was no longer tenable; and now the received doctrine is that very different effects may be produced by the same kind of ethereal matter when in different states or degrees of motion. Light, heat and actinism are supposed to be generated through one medium by transverse vibrations

varying only in velocity. It is not impossible that both magnetism and electricity may be manifested through the same medium; yet, on the supposition we could not accept the idea of Matteucci, that the latter force is the result of vibratory action, although it appears most probable that dynamic electricity is propagated by pulsations, which vary with the elements of resistance. For the present we may regard Franklin's theory of static electricity quite as plausible as any other, bearing in mind only that he applied the term "electricity" to a subtle fluid, while we now use that word to define the force manifested. We can only find room for the following extract from Mr. Quimby's interesting paper:

"The central idea of the Franklinean theory is, that a mutual attraction exists between electricity and all other matter; when matter is uniformly saturated with electricity, or, in other words, when the fluid is equally diffused, this attraction is balanced in all directions, and hence electricity is quiescent, producing no apparent effects. When this state, the equilibrium, as it is called, is disturbed, the balance of attraction is destroyed, and light bodies are set in motion in the direction of the greatest attraction. If they are deficient in electricity they move toward the nearest supply; if they contain an excess they are attracted in the directien of the greatest deficiency. Two contiguous negative bodies, while exerting no attraction for each other, are attracted by the electricity in surrounding matter, and, therefore, if they are sufficiently light, they recede from each other in obedience to the sum of the attracting forces to which they are respectively subjected. They may be made to move in the same direction by approaching the hand or some other substance, which, being a better conductor than the air surrounding them, and, being connected with the earth, will more readily furnish the supply of electricity which they seek. Each of the two negative bodies constitutes or establishes, as it were, with respect to the other, an electrical vacuum, and, as they both require a supply of electricity, they, of course, separate in opposite directions, unless we modify their situation by presenting a superior source of supply at some one point, when, as before remarked, they move toward that in obedience to what is obviously the greater attraction in that direction. Two light positive bodies separate because, being equally oversaturated, the excess of electricity, which they severally contain, carries them with it in its effort to impart itself to surrounding matter. The force which, operating in this

way, causes electricity to tend to an equal distribution, might be called, if we we were permitted to coin a term in familiar language, attraction of equilibrium. The attainment of a quiescent state, however, does not imply any cessation of this force, but merely uniform diffusion; and, therefore, perfectly equal attraction in all directions."

INK FROM ELDER BERRIES.

The Deutsche Industrie Zeitung publishes the following process: The bruised berries, after being kept in an earthern vessel for three days, are pressed and filtered. The juice is of an intense dark color, requiring about 200 parts of water to reduce it to the shade of dark red wine. To twelve and one-half quarts of this filtered juice add one ounce of sulphate of iron and one ounce of crude pyroligneous acid. The ink thus prepared has, when first used, a violet color, but, when dry, is an indigo blue black. This ink is superior, in some respects, to that prepared from galls; it does not become thick so soon; in writing it flows easily from the pen, without gumming, and the letters formed by it do not spread on the paper and run into one another.

KEEPING FRUIT.

After giving a condensed account of experiments in preserving the fruit of 1867, according to Prof. Nyce's system, which has already been fully explained in The Tribune, Tilton's Journal of Horticulture says: We think our readers will be struck with one remarkable difference between the fruit kept in this house and that preserved beyond its season in a common ice house, viz., that the former was longer in ripening, and kept longer when ripe, than that which had never been in the house, while fruit preserved in the ordinary ice house is well known to perish as soon as removed. Perhaps, however, this difference would not be so great in fruit taken from the house in warm weather, for it will be noted that nearly all that mentioned was removed from the house in the winter. The accounts of last year's crops are not so favorable; but this is said to be largely owing to the want of care on the part of those in charge of the house in maintaining a uniform temperature and degree of moisture. Constant care and vigilance in regard to these points is absolutely necessary, quite as much so as in managing a green house. The principles upon which the flavor and fragrance of fruit depend are extremely volatile; and, with all the attention that could be given,

fruit growers had previously failed to do anything more than to keep the winter pears a month beyond the usual time of ripening in an ordinary cellar; but summer and autumn years, such as Bartlett, Seckel or Louise Bonne, of Jersey, have never before been kept in perfect order until January or February. But those who expect to keep fruit perfectly, without the utmost care in gathering and handling, and the most scrupulous attention to neatness and cleanliness, as well as to the general management of the house, will certainly be disappointed. We may add that specimens of fruit taken from the house at Cambridge April 10th, 1867, were carried to England by Mr. Wilder, and presented to Mr. Rivers, by whom they were tested at a dinner party on the 23d of the same month, exciting much gratification and surprise at their perfect preservation; some of Mr. Rivers' guests being at first rather incredulous of his statement that beside having been kept over from the previous season, they had made a voyage across the Atlantic.

CRACKING OF COLLODION FILMS.

At a late meeting of the London Photographic Society, the Chairman, Mr. J. Glaisher, F. R. S., remarked that he had often regretted that ladies so seldom attended the meetings of the Society. He was glad to see two present at that meeting, and one of them, Mrs. Cameron, desired to say a few words to the members.

Mrs. Cameron said she wished to obtain the opinion of members as to to the cause of cracking in the film of her negatives. She produced a large negative of Sir John Herschel in April, 1867, which was now, together with many others taken by her, covered with honey-comb, like cracks. The collodion film appeared to be cracked under the varnish, the latter being intact. During the last six years she had taken about 600 negatives, and, during the last two years, about forty-five of these had cracked, the injury taking place at all seasons of the year. A long conversation and examination of some of the negatives alluded to followed, in the course of which it was pointed out that the cracks were through the varnish as well as collodion, and that they often resulted from the use of Sœhnee varnish.

Mr. Thomas said cracks in the collodion film had, unfortunately, been occasionally seen ever since the introduction of the collodion process, no matter what collodion or what varnish had been used, without the fault being due to either, but rather to the incompatibility of the same two samples when in conjunction. Changes in temperat re

and moisture would undoubtedly have their effect. A photographer of considerable eminence and large experience had recently told him that he found that negatives wrapped in paper never cracked, while similar negatives put away in plate boxes did so. He believed that where the collodion was made thick, with a view to secure dense negatives, the tendency to crack was increased, the thickness of the film affecting, of course, its contractibility, and this might sometimes account for some negatives produced with the same materials, and apparently under the same circumstances, cracking, while others remained perfect.

Mr. Blanchard said as Mrs. Cameron resided at Freshwater, her residence would be subjected sometimes to winds bringing much saline matter, and consequent moisture, and it was to this, he had no doubt, the cracks were due. The best mode of preventing the effect of damp was to pack the negatives in paper instead of keeping them in plate boxes. Referring to Mrs. Cameron's negatives, the appearance justified her impression that it was the collodion only, and not the varnish, which was cracked. This he would demonstrate by rubbing the surface with a little soot. It would be seen that by this operation he had once filled the cracks with soot, and made the negative capable of being printed without showing cracks.

After Mrs. Cameron had expressed thanks for this hint, Mr. Hooper suggested that one of the causes of cracking was moisture on the plate from the breath of the operator, which condensed on large plates during the process of coating with collodion.

Mr. Dallmeyer pointed out that some kinds of glass underwent a change, technically called "sweating," a certain exudation appeared on the surface, caused by excess of alkali in the manufacture. It was impossible to wipe such glass clean, and the presence of this exudation, causing dampness, might be the probable cause of cracking. Glass in this condition might be cleaned by the application of dilute sulphuric acid, one part of acid to four parts of water.

Mr. Hart concurred in the idea that the cracking was due to moisture, and mentioned that, owing to the bursting of a steam-pipe in his establishment, the walls had become damp on one occasion, when the films of the negatives in a cupboard all rose in ridges, finally causing cracks.

Mr. Howard expressed the opinion that moisture was the cause of the difficulty. He attached considerable importance to warming the plate thoroughly before varnishing, and, after varnishing, to drive off all traces of alcohol.

Mr. Elliot thought that plates should be wrapped in paper, and suggested that the paper should be made in water-proof with gutta-percha boiled in linseed oil, or with some similar substance.

The Speed of Electricity Through Land Wires.

According to observations made by G. Davidson, Astronomer, United States Coast Survey, on the night of the 28th of February, 1869, at San Francisco, Cal., on a loop of telegraphic wire extending thence to Cambridge, Mass., and returning to San Francisco, the return signal being received on a chronograph near that receiving the outgoing signal, it was found that the total interval of time between the two signals amounted to eight-tenths of one second. The entire wire was divided into eleven portions, of about 650 miles each, and connected by repeaters, which sent from one portion to the next a new electric current, having a greater speed than the original one would have had it continued beyond the first reach of 650 miles. It will be seen that the actual rate of transmission of each current over 650 miles cannot be deduced from these data by dividing the whole time by eleven, but we are assured that the practical speed of a series of currents combined by relays is at the rate of 7,200 miles in 0.8 of a second.

Changes in Female Animals.

A correspondent of The American Naturalist states that a doe was recently shot near Minneapolis, Minn., carrying a beautiful pair of antlers, each with four branches, and asks whether this is a new fact in natural history or not? To which the editors reply that they have never heard of a female deer assuming the characters of a male before; but it is a well established fact that female birds living to old age often assume the plumage, and, to a certain extent, the habits of the male. In the museum of the Peabody Academy of Science, at Salem, Mass., there is a pea-hen, that in the spring before her death, at the age of nineteen years, changed her dull female plumage for the bright plumage and full trail of the male bird. N. Vickery, taxidermist, of Lynn, Mass., has the specimen mounted.

After some discussion on the foregoing items, the next topic presented was the

Aurora Borealis.

Dr. A. W. Hall read a portion of his paper on this subject, which occupied nearly the rest of the evening, in which he ascribed these phenomena to reflected solar light.

Dr. J. V. C. Smith remarked that while in England he was told by Dr. Scoresby, that the display of the aurora borealis in the Arctic regions was superior to any pyrotechnic display he had ever seen, and he stated that the hissing noise spoken of, was distinctly heard.

Dr. P. H. Vanderweyde said the paper of Dr. Hall was an elaborate and able one; it was, in fact, an able defense of a doubtful position. All his observations proved the opposite of Dr. Hall's theory. The compass needle he always found to be affected during the day of an evening display of the aurora. The northern light, when the hissing noise is heard, must be much nearer than fifty miles to the earth. The passing of electricity through the Geissler tubes will much resemble the aurora borealis. If the electric current is passed through one of these tubes, filled with nitrogen gas, we have a healthful display. We are not certain that the aurora borealis is due to electric action, but it is highly probable. As this subject would be continued at the next meeting, he would reply more at length to Dr. Hall's theory.

Adjourned.

October 21, 1869.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The proceedings were opened by the presentation, from the chair, of the following items of scientific news:

Benefits of Vaccination.

Previous to the introduction of vaccination the annual death-rate from small-pox was 3,000 to the million, which has been gradually reduced in Europe, in proportion to its being made compulsory; and last year the rate was only 202 to the million.

A New Cure for Consumption.

Dr. Clersoy of Langres, France, gives an account in the Bulletin de Therapeutique of several cases of pulmonary complaints accompanied with spitting of blood which have been cured by the use of arseniate of soda, administered daily in doses of six milligrammes, *i. e.*, nearly one-tenth of a grain each.

New Figures Formed by Electricity.

M. Kundt describes in Poggendorff's Annalen a kind of figures differing from the well-known Lichtenberg figures which are formed

by electricity when very finely powdered substances, such as lycopodium, are applied to an insulator. The new figures are formed on the conducting surface, and are less dependant than the Lichtenberg upon the peculiar kind of electric developer employed.

Improvement in Rolling Iron.

Mr. Robert Robinson of England has invented an improved roller for manufacturing iron plates, bars, rails, &c., which has been successfully used at the Coalbridge Iron Works. The new roller is tubular instead of solid, with a stream of water inside for the purpose of keeping it comparatively cool and preventing undue expansion. It is from seven to eight cwts. per ton lighter than the common roll, and the brass bearings are proportionately lighter. The saving in first cost is estimated at fifteen per cent, and the new rolls will last much longer than solid rolls. No scales stick to the hollow rolls; therefore, the finished bar or plate made by them presents a finer surface.

Leakage Alarm.

Mr. F. de Coninck, ship owner, of Havre, France, has been led, by recent accidents which have occurred from the entrance of water into ships' holds not being discovered until the pumps were of no avail, to design an apparatus for the purpose of indicating, at all times, by an alarm, the rise of water in the hold. The principle of the apparatus is that of a float in communication with an alarm-bell, provided with a ratchet and detent arrangement and counter weight, which in their normal condition, maintain the apparatus in equilibrium, but, as soon as the float rises by the ascent of water in the hold of the vessel, the equilibrium is destroyed, and the ratchet which prevented the movement of the striking apparatus being withdrawn, the alarm is set in motion. The only condition necessary to the working of this indicator, is the winding up of the weight, which gives motion to the striking machinery.

The Ear.

Dr. A. Cousin's paper, in a recent number of a French journal, treats of injections and instillations into the ear. He considers lukewarm water the best and most innocent emollient that can be used for that delicate part. Milk, various oils, mucilaginous and narcotic decoctions, which the public believe so safe, leave organic substances

behind, which, after a short stay in the meatus, begin to ferment, and thus cause fresh irritation. A little pure glycerine may be added to the water, in which it is perfectly soluble. The injection should be made with a syringe having an end large enough to prevent its penetration too far into the meatus and hurting any part. Moreover, the liquid should go in very gently, so as not to give any violent shock to the tympanum, which, should it happen to be thin, would run the risk of rupture. On the other hand, in order to be sure that the liquid column will penetrate to the bottom of the meatus, the latter should be kept as much as possible in a perpendicular position during the operation; a precaution of double importance when it is required to get any extraneous substance out of the ear. Many very ingenious instruments have been invented for the purpose of extracting substances from the ear, but, according to the author, they are all useless when not dangerous. The method he proposes is simple enough, and appears to answer any emergency. It is an extremely rare, perhaps an impossible case, that an extraneous body should happen to fit so exactly in the meatus as completely to obstruct its passage; it generally leaves interstices, through which water poured into the ear must necessarily penetrate to the furthermost end. Now the liquid, so introduced, will gradually rise, and exercise a pressure upon the intruder from behind, and, in a manner, set it afloat. Dr. Cousin declares he has never known an instance of this simple method to fail; but that, on the contrary, it has succeeded in cases where extraction with instruments had been tried in vain by the most dexterous hands.

The Effect of Freezing.

The London Daily News says it is not true, as generally supposed, that the act of freezing eliminates from water all impure matter. It generally does extrude coloring matter, but not organic impurities; indeed, such matters, although prevented from decomposing by the cold, appear to decompose with redoubled energy immediately the temperature is sufficient to melt the ice which holds them.

Advantage of Powdered Lime for Mortar.

A French engineer has made an able report on the economy of using lime ground to a fine powder, instead of slaking it in lumps. He estimates the loss in using lumps at twenty-five per cent. Besides this saving of material it is found that lime in powder is spread with

greater facility, and the mortar thus made sets quicker and is more solid.

BRONZING PORCELAIN.

Bottger gives a simple process for bronzing porcelain, stoneware, and composition picture frames, which consists in covering the articles with a thin solution of water-glass, applied with a soft brush, and then sprinkling the surface with bronze powder. The article is next heated, and when the silicate of soda or water glass is dry the bronze will become firmly attached, and may then be polished or burnished with agate tools.

OXYGENATED WATER IN THE ATMOSPHERE.

M. Struve sends to the French Academy some interesting facts from Tiflis, the capital city of Georgia in Asiatic Russia, observed by him in reference to the quantity of nitrate of ammonia, ozone, and oxygenated water (peroxyd of hydrogen) present in rain water obtained from melting snow and hail. The author used oxyd of lead as a test, which was converted into peroxyd.

SOLUBILITY OF SULPHUR IN COAL OILS.

M. Pelouze has sent a paper to the French Academy of Sciences on the solubility of sulphur in oils derived from coal. He shows that the denser the oil the greater the quantity of sulphur dissolved at equal temperatures. Thus, at 100° Centigrade, or 212° Fahr., oil of the density of 1,020 will dissolve as much as fifty-four per cent, while a light benzine, having a density of 0,870, will not dissolve more than 15½ per cent. At 110° C., the power of solution of certain oils is as much as 115 per cent, and above 120° C., or 248° F., it is almost unlimited.

MATERIAL FOR STAINING GLASS AND FAIENCE WARE.

According to the analysis made by Dr. H. Schwartz, the substance producing a bright brown color was found to consist, in 100 parts, of oxyd of chromium, 11.30; peroxyd of iron, 21.00; alumina, 18.02; oxyd of zinc, 50.90. This material is prepared by dissolving in water 71 ounces of chrome alum, 60 ounces of persulphate of iron, 160 ounces of alum, and 180 ounces of sulphate of zinc, which, after having been mixed and precipitated by means of carbonate of soda, are collected on a filter, washed, dried, gently ignited, and rubbed to a powder in an agate mortar.

Sunflowers as a Preventive of Intermittent Fevers.

In consequence of experiments long since made in this country and of the publicity recently given to the statements made by M. Martin, before the Societè Therapeutique of France, on the admirable results obtained by planting the sunflower as a disinfectant of the miasma causing intermittent fever, the Minister of Agriculture and the head of the Sanitary Bureau in the Department of the Interior in Italy have been actively engaged in promoting measures to secure the like desirable results in the most fever-stricken districts in that kingdom.

In regard to the last item read, Dr. Vanderweyde remarked, that in a recent journey in Omaha he had found dense growths of sunflower plants, extending for hundreds of miles. These were said to have sprung originally from seed accidentally sown by emigrants on their way to the remote West.

Dr. J. V. C. Smith said that the Spaniards, under De Soto, found the sunflower one of the principal products grown on the Mississippi river, at the time of its discovery. Its uses by the aborignes are not known, but it is thought that the oil from the seed was used as a substitute for butter in cooking, and that it supplied the place of animal fats, in the practice of the primitive arts of the savages.

Mr. J. K. Fisher stated that the sunflower seed oil, for painting purposes, was inefficient, because of its inability to dry by the use of litharge, etc., and it is of little value as compared with animal oils for lubricating purposes.

Dr. D. D. Parmelee remarked that the manufacture of cotton seed oil was formerly considered of little worth, but great developments have taken place. Among the uses it is now put to is that of adulterating olive, or sweet oil. The cotton seed oil being exported to Italy, and brought back under the name of olive oil.

Dr. Vanderweyde stated that of late cotton seed oil is made very white and clear, and largely applied to the uses mentioned by Dr. Parmelee.

Safety Railroad Truck.

Mr. David McFarland exhibited a model of his safety railroad truck, in which the journals, safety straps, and the guards arranged over the wheels are so applied, that in the event of the breaking of the axle the car will be prevented from running off the track, and thus avoid serious accident.

Mr. J. K. Fisher said that a plan of life insurance by railroad companies would tend best to secure greater care for the safety of passengers, and the use of iron cars and fire-proof wood, and the employment of first quality materials generally, would be much better than costly safety appliances.

Aurora Borealis.

Dr. A. W. Hall further explained his theory of the aurora borealis as being due to the reflected light, and Dr. P. H. Vanderweyde defended the electric theory as advanced by Humboldt, Faraday, Arago, Herschel, and the other eminent scientist's, after which the association adjourned for one week.

October 28, 1869.

Professor S. D. Tillman, Esq., in the chair; C. E. Emery, Esq., Secretary.

The Chairman presented the following scientific notes:

Contraction of Rubber by Heat.

The Paris Les Mondes says that M. Govi, of Turin, has repeated the experiment which proves that stretched caoutchouc will contract when heat is applied; but he finds that such contraction only takes place within certain limits of temperature; and that if a greater degree of heat be applied, though not enough to reduce it to a pasty mass, the rubber expands and becomes rapidly longer. This substance, which has in some aspects puzzled philosophers, especially as regards some of its physical properties, has been frequently considered to consist of a kind of solid foam, made up of a large number of vesicles filled with gas. This theory has been proved to be a reality, since Payen and others have seen the vesicles under the microscope, while M. Govi has succeeded in expelling a portion of the gas from the vesicles by softening the rubber with oil of turpentine, and withdrawing, by means of an air-pump, the ordinary atmospheric pressure. The peculiar constitution of caoutchouc being admitted, it is easily seen that when that material is stretched, the vesicles will lengthen in the direction of the stretching force, and consequently become more narrow in a perpendicular direction to that force. When, under these conditions, the caoutchouc is heated, the gas within the vesicles, while expanding, will have a tendency to

return to the spherical shape it possessed before being stretched, and this explains the paradox of its becoming shortened by increased temperature; in other words, contracting instead of expanding by heat.

DOUBLE REFRACTION.

Professor Tyndall, in a recent lecture "On Light," at the Royal Institution of London, thus very clearly explains the phenomenon of double refraction, according to the theory that all luminous effects are the result of undulations of a highly attenuated and subtle fluid which pervades all space and permeates all ponderable matter: "In air, water, and well-annealed glass, luminiferous ether has the same elasticity in all directions. There is nothing in the molecular grouping of these substances to interfere with the perfect homogeneity of the ether. But when the water crystallizes to ice, the case is different; here the molecules are constrained by their proper forces to arrange themselves in a certain determined manner. They are, for example, closer together in some directions than in others. This arrangement of the molecules carries along with it an arrangement of the surrounding ether, which causes it to possess different degrees of elasticity in different directions. In a plate of ice, for instance, the elasticity of the ether, in a direction perpendicular to the plane of freezing, is different from its elasticity in a plane parallel to the same surface. The difference is displayed in a striking manner by Iceland spar, which is crystallized carbonate of lime; and in consequence of two different elasticities, a wave of light passing through the spar is divided into two, the one rapid, corresponding to the greater elasticity, and the other slow, corresponding to the lesser elasticity. Where the velocity is greatest, the refraction is least, and where the velocity is least the refraction is greatest. Hence in Iceland spar, as we have two waves moving with different velocities, we have double refraction. This is also true of the greater number of crystalline bodies. If the grouping of the molecules be not in all directions alike, the ether will not be in all directions equally elastic, and double refraction will infallibly result."

ACTION OF THE CUTICLE OF PLANTS.

M. Barthelemy has applied the principle of osmosis in explaining plant respiration. In plants there exists a cuticle which has a chemical composition and a physical constitution somewhat resembling caoutchouc. It is not found at the stomata on the under surface of

leaves. As the exhalation of oxygen is greatest when sunlight falls on the upper surface of leaves, Barthelemy explains this by supposing that the respiration takes place through the cuticle of the upper surface, while the stomata or pores of the under surface perhaps absorb only nitrogen.

HEARING ORGANS OF CRUSTACEA.

Sir John Lubbock, in discoursing on crustacea, says: We do not understand how they see, smell, or hear; nor are entomologists entirely agreed as to the function or the structure of the antennæ. This interesting subject offers a most promising field for study, and I would particularly call the attention of entomologists to a remarkable memoir by Hensen, on the auditory organ in the decapod crustacea. Hensen has shown that the otolithes in the open auditory sacs of shrimps are foreign particles of sand, introduced into the organ by the animal itself. He proves this very ingeniously by placing a shrimp in filtered water, without any sand, but with crystals of uric acid. Three hours after the animal had moulted, he found that the sacs contained many of these crystals. M. Hensen has also shown that each hair in the auditory sac is susceptible of being thrown into vibration by a particular note, which is probably determined by the length and thickness of the hair. It may be experimentally shown that certain sounds throw particular hairs into rapid vibration, while those around them remain perfectly still.

ENDLESS CHAIN SAW.

Mr. D. L. Kennedy exhibited his endless chain saw. It is made up of links or sections, each one complete in itself, and joined to its fellows by a hook joint, having no lap or pivot. A number of these complete the saw, which is carried by two grooved pulleys or wheels, one of these having adjustable bearings, so as to strain the saw to any required tension. This saw claims to possess the good points peculiar to both the straight line action of the reciprocating saw, and the continuous movement of the circular saw.

The inventor claims that the following are some of its leading advantages.

1st. *Its Unlimited Dimensions.*—As it can easily be extended from cutting *two feet* timber to *six feet* timber, by raising the upper wheel, and adding the requisite number of sections, the thickness of the saw remaining the same. To do this with a circular saw would require

one (if it could be made) of a diameter equal to the length of an ordinary log, at a cost of hundreds of dollars, and a thickness of not less than *half an inch.*

2d. *Its Continuous Motion.*—A subject, however, too well understood to need further comment.

3d. *Its Straight Line Action*, and at the same time, its capability of being adjusted to *any angle* of the wood, as in the case of the hand-saw. Every sawyer knows that the manner in which a circular saw enters the wood, at first *dead against the grain*, and from that gradually working its way out in a quarter circle, is the very hardest process of doing the work, and consequently requires the most power. All this is entirely overcome in the endless chain.

4th. *The Limited Extent of Injury by Accident.*—As the destruction or damage of two or three teeth only involves the *section* of which they are a part, that section can be replaced by a new one in a few minutes, without any injury to the rest of the saw. If the obstruction be of a character to destroy a circular saw, or tear out every adjustable tooth, the section of this saw encountering it, would break, and the saw stop; *the broken section being the only loss.*

5th. *The small Power Required.*—For two reasons; first, it cuts *with* the grain; and, second, the edge of the saw is but a small distance from the center of the motion. If the lower wheel J, which drives the saw, be twenty-four inches in diameter, it is equal to a circular saw, that will cut *but nine inches* into a log, whereas this saw can be extended upward *four feet*, without increasing the distance of the teeth from the center of power.

6th. *Its Economy in Wood.*—As it is held in tension, it can be made much thinner, and thereby cut *more boards* from the same log, than the circular saw; the gain being about ten per cent.

7th. *Its Great Saving in Wear and Tear of Machinery*, as it requires much less speed. This saw works from pure force or strength; whereas a large share of the cutting ability of the circular saw is from sheer momentum.

8th. It forms a perfect planer by setting and sharpening the sides of the teeth on every fourth or fifth section.

9th. It is made of tempered steel, and ground to a *cutting* edge.

10th. It can be furnished at far less cost than the circular saw, and as the sections for the largest kind of saw can be packed in a very small compass, it is easy of transportation, and not liable to damage.

The Chairman remarked that the two largest circular saws exhi-

bited at the late fair of the Institute, cost, one twelve hundred, and the other one thousand dollars. An endless chain saw, capable of doing much larger work, could be sold at one-tenth these amounts.

New System of Docks.

Professor J. A. Whitney explained the system of proposed docks of Mr. Thomas Bracher, of Rahway, N. J., a model of which was exhibited. Each dock was to consist of granite blocks laid in cement, and secured by iron clamps—the superstructure supported upon twenty-four arches, about thirty feet wide, and resting upon a a suitable foundation, with a space of ten feet between each arch, the height of which should be proportioned to the average depth of the water. Within the granite piers thus formed, should be provided large store houses, fitted with apparatus worked by steam for carrying and hauling merchandise, etc. Along the edge of each a line of warehouses was proposed, communicating with the storage vaults beneath. The outlet of these vaults was indicated as being to a building at the inner end of the pier; and it was suggested that the buildings on the line of piers could be used as the superstructure of an elevated railway line to belt the city. A model of a coffer dam, also invented by Mr. Bracher, was shown. It embraced the novel plan of locking together the vertical edges of the sections of the dam by means of hook lugs furnished upon the edge of one section, and acting in conjunction with a longitudinal rib formed upon the corresponding edge of the adjacent section—the two keing held together by keys, and the joint caulked in the usual manner.

Vegetable Oils.

This subject having been introduced, Prof. Whitney remarked that the most important vegetable oil is that made from the olive fruit. This is gathered when nearly ripe; it then resembles a small damson or plum with a very hard stone in the center. The ripe fruit is crushed in a mill, and the product is put in bags made of rushes and subject to slight pressure. This secures the finest quality of the oil. The residue is broken up, treated with water, allowed to ferment, and again pressed. This produces an inferior quality. The former is used as a salad oil; the latter, in England, for dressing woolen cloth in the process of manufacture. On the continent it is employed in soap making. In Spain and Italy it serves as a substitute for cream and butter. Palm oil is made from the thin fleshy covering

of the seed of an African palm. It has the consistence and something of the color of butter, and is used in this country for making palm oil soap. The process of making the oil differs from that of making olive oil. The pulp stripped from the seed stones, has boiling water poured upon it, whereupon the oil floats and is skimmed off. A substance called palmitic acid is derived from it, and used in the manufacture of candles. Cocoa nut oil is largely made in Ceylon. The kernel is ground in mills and pressed, the ground material is called copperah. Linseed oil is made by grinding the seed and subjecting it to great hydraulic pressure. It is a good drying oil, as it is easily oxydized. It may be evaporated to a gummy consistence, and vulcanized as a substitute for india-rubber. Castor oil is made with or without heat, from the beans of the Palma Christi plant. It is used in India for burning. Poppy seed oil is produced very largely in France; a white poppy is grown exclusively for the purpose. It is esteemed as an excellent substitute for olive oil. Almond oil is expressed from the kernels of the nuts, and forms a very bland and valuable oil. One hundred weight of almond kernels are required for fifty pounds of oil; but with the bitter almonds an essential oil may be expressed from the marc or residue. A very curious substance is the product of the Chinese tallow tree. It is extracted from the seeds by placing them in boiling water. It is white and harder than common tallow. Vegetable oils when used on leather are deleterious to the strength and durability of the material.

Dr. Vanderweyde said he was much in faver of the castor bean as a lubricant. Much difference exists in the nature of the various vegetable oils. His experience with castor oil on leather was very favorable, and he proposed to test the utility of this oil still further by using it on one boot and fish oil on the other. He would report the result at a future meeting.

Adjourned.

November 11, 1869.

Professor S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The following notes on science were presented by the chairman:

A Test for Colors.

M. Nickles has found that fluoride of potassium will discharge a Prussian blue color, and not affect the indigo and aniline colors. This

information will interest calico printers. A fact of more general interest is that fluoride of potassium will remove ink stains from cloth.

DETECTION OF ARSENICAL PIGMENTS.

During the first five months of this year no less than eight cases of accidental poisoning by these pigments have occurred at Nuremburg. M. Puscher advises the use of liquid ammonia for the detection of such pigments, all of which, he says, are soluble therein, exhibiting a blue coloring solution, if copper is at the same time present; he further states that on the evaporation of the ammonia there remains a dirty greenish colored precipitate of the arsenite of oxyd of copper. His advice is to paint some white paper with this solution in ammonia, which painting, when dry, if arsenic be present, will exhibit a dirty greenish color; but if, after drying, a blue color appears to have been imparted to the paper, the pigment is quite free from arsenic, and only consists of a copper compound. There are several green and blue pigments of this kind, which are all soluble in ammonia, except such adulterations as do not essentially belong to the pigment itself.

REGENERATION OF LIMBS.

M. Philippeaux's experiments on the regeneration of limbs have been repeated by Milne Edwards, who has described some new results in a communication to the French Academy of Sciences. His early experiments on reptiles prove that if the limbs of a newt be cut off, the scapula or ilium being left behind, the limbs will be reproduced; but if the scapula is removed, the limb is never reproduced. His recent experiments with fishes give similar results. If the fin rays of a fish be cut off, they will be reproduced; but if the part corresponding with the scapula be removed, no reproduction will take place.

PHOTOGRAPHIC AID IN SURVEYING.

The following is an extract from the report of Regnault, Fizeau, and Abbadie to the French Academy of Sciences upon an ingenious invention by the late Mr. A. Chevalier, which is destined to become of great service in the art of surveying:

When Daguerre first employed the camera for the purpose of fixing images upon a metal plate, Arago at once suggested that topography might borrow from photography its rapid means of registration. The view taken by this great physicist gave rise to

divers projects to bring about the solution of the problem; and five years later M. Martens showed how it was possible to fix upon the surface of a cylinder a succession of images received through a narrow slit, by means of a movable lens. In this manner M. Garella, Engineer-in-Chief of Mines, proceeded to perfect the instrument in such a way as to render it possible that images might be taken on a plane surface, and that the whole tour of the horizon might be secured. The details of the instrument were exceedingly ingenious; but when it was desired to construct a plan, long calculations and deductions were necessary, causing delay, and giving rise to the possibility of errors.

Seventeen years after the invention of Daguerre, Mr. A. Chevalier stated in precise terms the problem to be solved, establishing the fact that in order to obtain a plan upon paper, it was necessary to construct at each station, a special protractor, formed photographically by the whole of the surveying signals which the instrument registers automatically, according to the angular separations, as observed by the eye from the station selected. This result Chevalier obtained by causing a vertical lens to make the tour of the horizon by means of clock-work mechanism, and thus to secure images of the signals situated around the station. These images are thrown by means of a reflecting prism in rigid connection with the lens, through a slit placed above a horizontal sensitive plate. The axis of this slit forms a part of the movable vertical plane, which contains at once the optical axis of the lens, and the center around which it moves in azimuth. The slit opens automatically and without vibration, after the lens and the prism have already acquired a uniform rotary movement. When the tour of the horizon is finished, the slit closes of itself, and the whole apparatus may be turned horizontally until the needle of a compass attached coincides with the zero upon its disk; then by opening an aperture specially constructed for the purpose, the light is allowed to trace on the margin of the plate a line indicating on the picture the direction of the magnetic meridian. This precaution serves to give the direction to the negative, and allows the draftsman, when constructing his plan, to identify the several combinations of subsequent tours of the horizon.

In this circle of photograpic images, all the signals preserve between themselves the true angular separation as seen from the station. In rare cases, where the signal is too high or too low in relation to the instrument, a small lens, movable round a horizontal

arm fixed upon the apparatus, allows of recording this signal upon a landmark in the field of the instrument. Finally, a hairline, produced by means of a thread situated at the hight of the optical axis, shows all the points in the photographic panorama, in which the hight is equal to that of the station whence it operates. The employment of the apparatus requires no other special knowledge than that of photography. To comprehend the great simplification thus brought about in the art of surveying, let us repeat the details of the methods hitherto used:

After having, with considerable trouble directed the optical axis of the telescope in the theodolite separately upon each signal, the figures of the levels are taken down in succession. When the levels are very numerous, several hours are necessary for making one entire tour of the horizon. A protracter is now placed in position, and, after having been noted, is directed in succession to horizontal angle. These several operations are very long and tedious, and often errors are committed which are more difficult to correct the higher they mount up. The ordinary theodolite is only really preferable when it is desired to obtain the most precise results by calculating the construction of each triangle.

On the other hand, the photographic plane-table will complete tour of the horizon within half an hour, and the number of signals may be multiplied without in any way rendering the task more laborious. By increasing the number of original signals there is less risk of error, and of subsequent rectification, and much intermediate work and calculation obviated. Less cars and skill are required in its employment, and inclemency of weather becomes a matter of little importance. The committee state that the instrument has already been used with great advantage, and in some cases errors have been discovered in standard maps by its use. They say, in conclusion, that after twelve years of incessant study, Mr. Chevalier has died at the moment when he had hoped to see his invention adopted by learned bodies, and suggests that so novel and ingenious an application should be honored by the high approbation of the Academy of Sciences.

ELECTRICITY.

The view long entertained by some American scientists regarding electricity is similar to that expressed by the Rev. Father Secchi of Rome, in a letter addressed to M. F. Mazco at Turin, the following extract from which appears in the Paris Les Monde: "I believe that

the true theory of electricity will result from the principle that electricity is not a motion, but a change of the quantitative and dynamic equilibrium of the ether which constitutes the atoms of the substances, and that the propagation of such a change is brought about by the moving of the ether from one atom to another; this motion shakes, disturbs the ether of the atoms, and thus produces heat."

Inexhaustible Manures.

In the Atlantic Ocean, a little west of the Azores, there exists a space seven times larger than all Germany, according to Humboldt, completely covered with a dense mass of vegetation, the so-called Sargassa sea. M. J. Laviniere has proposed to the French Agricultural Society to make these floating meadows subservient to the purposes of agriculture. He suggests that the ships occupied during the summer cod-fishing should, in other seasons, be employed in conveying these weeds to the Azores, where they can be pressed and dried, and after having valuable salts extracted from them, they could be carried to the French coast. It is calculated that the floating meadows produce annually vegetable matter sufficient to manure not less than 1,800,000,000 acres.

Portable Gas Machine.

Mr. L. D. Tousley exhibited a new apparatus for a portable gas machine. He claimed that gas could be made by it not to exceed seventy-five cents per thousand feet, and a much better light than that of ordinary gas. This machine is so arranged that portions of the benzine or liquid hydrocarbon employed in the manufacture were exposed in succession to currents of air, which by absorbing the hydrocarbon, are rendered inflammable, and pass through suitable pipes to the burners. The novelty in this machine is that no gas holder is used, as the gas is made just as it is consumed, and no faster. This insures safety. It is also simple and durable. There is connected with the machine what is called a safety can; it is a reservoir for the naphtha. Perfect control is had over the material and, therefore, the machine is absolutely safe in every house.

Dr. J. B. Rich remarked that there has not yet been made any device which rendered the use of naphtha safe. This benzine is the lighter product of the oil, therefore, it must be condensed; and it is not practicable to carry the gas through a long range of pipe without the pipe becoming cold and the gas condensed; hence the light

would be rendered uncertain during the winter months, and it is also highly explosive. All machines of this nature are dangerous, and should never be put in practice. The gas cannot be conveyed through cool pipes any distance. We have numerous machines for cooking and lighting, but none of them are practical, and never should be used by the public.

Mr. Tousley replied by denying most emphatically that the gas was explosive, the material is always under control. Street gas would condense more than that of this machine. At the late fair of the American Institute this machine was placed fifty or sixty feet from the building, and the gas was passed through an ice-box, and though the weather was very cold, there was no condensation of the gas in the pipes. The naphtha at no time is exposed to the air.

Dr. D. D. Parmelee said it is only a question of time when an explosion will take place in this machine. There is no apparatus based on this plan that is safe. The mixture of atmospheric air with the gas renders it very unsafe. A certain quantity of benzine has to be stored for use, and this is a dangerous product, and should not be used; it is only safe in the chemist's laboratory.

Mr. Tousley stated that the naphtha is mixed with the air only when in actual use, about one inch of the naphtha is exposed at a time, and this is pushed forward as fast as it vaporizes. It is not exposed till the light is burned. The air never comes in contact with the vapor till it is used. There will be no residuum after a years use. The reservoir is placed away from the house and can be put under ground.

Dr. Rich stated that to make this gas safe we must do away with the dangerous properties of naphtha.

Dr. Parmelee remarked that the vapor of gasoline is heavier than the air, and so it will accumulate in the lowest places, cellars, &c., it is not like our street gas, which is lighter and ascends.

Feathered Oars.

Mr. Nicholas Nolan exhibited a model of his improved apparatus for propelling vessels. It consisted of oars suspended two at each side of the vessel, and operated by gearing. As one pair propels the vessel, the other pair is feathered and moved in a reverse direction.

Mr. Hamilton E. Towle said he doubted the efficiency of this method of propulsion. It was complicated, and the principle had been used before and abandoned.

Winding Stairs.

Mr. W. I. Keims exhibited models of his various styles of winding stairs. There were double and triple pairs of stairs; the whole could be revolved, as the center post rested on a pivot. Persons could ascend one pair of the stairs while others would be descending the other. The stairs were claimed to be self-supporting.

Mr. C. E. Emery admired the ingenuity of the staircase, but stated that it was not as strong as it appeared. The actual base of the structure was equal to the width of one stair only.

Orinoco Valley.

Dr. R. P. Stevens read a paper on the scenery and products of the Orinoco Valley, of which no report has been furnished.

Adjourned.

November 25, 1869.

Professor S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The Chairman opened the proceedings by reading the following notes on science:

A Milk Mushroom.

M. Hesling states, in the Journal de Pharmacie et de Chimie, that even long before milk becomes sour, there are generated in it very small organized spores of an *ascophora* species.

Consuming Smoke.

A contrivance for consuming smoke has been invented in Pennsylvania. It consists of a box containing a fan, attached to the firebox of an engine, so as to catch smoke and drive it back into the furnace, where it is consumed. Thus a large saving of fuel is effected and the smoke nuisance is abated.

An Electrical Insect.

It is reported, on the authority of the late Major-General Davis, of the Royal Artillery, that the *Reduvius serratus*, commonly known in the West Indies as the "wheel bug," can, like the *Gymnotus electricus*, communicate an electric shock to the person whose flesh it touches.

To Prevent the Oxydation of Iron Ship-bottoms.

Prof. Calvert has recently made experiments on iron rust, and expresses the opinion that the oxydation of that part of an iron ship exposed to water might be prevented by coating such surface with an alloy of lead and antimony, and by placing an alkaline compound in the bilge water within the vessel.

Artificial Light.

According to Landsberg, a German chemist, artificial light contains ninety per cent of calorific rays, while sunlight contains only fifty. To this predominance of heating power, as compared with illuminating power in artificial light, he attributes the disagreeable sensation produced upon the eyes. Very thin sheets of mica will intercept the calorific rays and render the light more agreeable.

The Effect of Electricity upon Blood.

Professor Neumann, of Königsberg, in studying the action of electricity upon the animal organism, has recently found that, under the influence of powerfully induced currents, the white blood corpuscles of the frog swell up. Between their walls, which become very smooth, and the interior granular nucleus, a free space is left; and the granules of the nucleus manifest rapid movements.

Salt as a Manure.

M. Velter having, some time since, published an article "on the utility of common salt to agriculture in consequence of its ulterior transformation into carbonate, and lastly to nitrate of soda," M. Peligot furnishes a criticism thereon to the Journal de Pharmacie et de Chimie, in which he gives the results of his own researches. He finds that when common salt naturally occurs in an arable soil some plants assimulate this salt, but the greater number do not.

The Refractive Energies of Metals.

Dr. J. H. Gladstone read a paper before the British Association, at the Exeter meeting, on the relation of the refractive energies and the combining proportions of metals, in which he stated that, in most cases, but not all, the less the combining proportion of the metal the greater is the refractive energy. The rule seems to prevail among those metals which form definite salts, such as magnesium, iron and zinc, but does not hold at all with non-metallic elements. The coin-

cidences pointed out by Dr. Gladstone do not show any definite relation between the atomic weight of metals and their respective refracting power.

BEACHWOOD TAR.

M. Longuinine stated, at a meeting of the Chemical Society, of Paris, that when this tar is distilled along with water, there is obtained a light, yellowish colored oil, which, on being treated with caustic potash, yields a crystalline compound, due to a peculiar phenol, which constitutes about one-fifteenth of the entire quantity of oil obtained. The remainder of the oil yields chiefly tereben, boiling and distilling over between 160 and 180 degrees C. The phenol obtained has some of the virtues of ordinary phenol or carbolic acid, and exhales that peculiar and well known smell of Russian leather, which is tanned with birch bark, and is chiefly employed for book-binding purposes.

A CURE FOR BURNS.

A valuable discovery was accidentally made by a workman in France, who, some, little time ago, in varnishing various pieces of metal, scorched himself most dreadfully. In his agony, and without an instant's reflection, he thurst his injured hand into the pot containing the varnish, and immediately felt relieved as if by enchantment. He repeated the operation for a day or two, and in a short time was perfectly cured. The discovery attracted considerable attention in the neighborhood. He was sent for to Metz to cure some men injured by a powder explosion; and, being successful, he was directed to apply his cure to patients in the hospitals of Paris, where his treatment for burns was soon found to be more efficient than the old method.

NEW USE OF BRAN.

M. Poncelet proposes, in the Moniteur Scientific of Paris, to use a certain quantity of bran, which contains from forty to sixty per cent of its weight of starch, instead of malt or raw grain, for the purpose of brewing, and for the manufacture of starch. He either uses the bran as it is, or extracts the starch previously, and adds to it the materials required for the mash-tubs.

SULPHUROUS ACID GAS FOR DISSOLVING BONES.

M. Coignet, of Paris, for the purpose of extracting gelatine from bones, places them in cold water and forces a current of sulphurous

acid gas through the water until the bones become completely softened. They are afterward washed in water wherein some of the gas has been previously dissolved. It is well known that hydrochloric acid is used for the same purpose, but it is objectionable on account of the formation of chloride of calcium, which intereferes with the drying of the gelatine.

Fluosilicic Acid for Refining Sugar.

M. Marix has obtained a patent in France for the employment of fluosilicic acid in purifying beet-root and other saccharine juices. The juices are diluted with water, to remove viscidity, and sufficient fluosilicic acid is then added to precipitate all the salts of potassium; powdered chalk is then used to saturate any excess of the acid. A clear liquid is next obtained by filtering, which is treated afterward in the usual manner.

Effect of Heat on Galvanic Batteries.

M. Crova, in the Paris Cosmos, gives the result of his researches as follows: 1. The electromotive force of a Daniell element decreases regularly with the increase of temperature; (this conclusion is directly at variance with that of the best American electricians.) 2. The force of a Grove element increases with temperature. 3. The force of an element containing only one liquid, as in Smee's battery, is independent of the variations of temperature.

Antimony for Galvanic Batteries.

M. Böttger, is reported in a Paris journal as recommending for force and durability, the following arrangement: A cylinder of amalgamated zinc is placed in a concentrated solution of equal parts of common salt and sulphate of magnesia; the antimony is placed in a porous cell filled with dilute sulphuric acid.

Hungarian Wheat.

It is well known that the composition of wheat varies slightly, according to climate and soil. Samples of Hungarian wheat from the extensive granaries of Pesth, have been analyzed, and O. Dempwolf reports the result for 100 parts: Water, 10.511; ash, 1.505; gluten, 14.352; starch, 65.407; fatty matter and woody fiber, 8.225. The existence of sugar could not be proved. The chief ingredients of the ash were found to be—phosphoric acid, 49.902; potash, 31.825; magnesia, 14.862 per cent.

CARBON SEPARATED FROM DIFFERENT COMBINATIONS.

M. Berthelot, of Paris, has communicated to the Comptes Rendus a paper "on the immediate analysis of different varieties of carbon," in which he describes the influence, upon varieties of carbon already formed, of sundry agents, such as heat, chlorine, iodine, oxygen, and electricity, also the characteristics of carbon extracted from the various compounds. He states as the result of his experiments and observations on the latter subject, that carbon when separated from compounds containing hydrogen, takes the condition of amorphous carbon; while that derived from its combinations with chlorine, sulphur, boron, and perhaps oxygen, inclines to the state of graphitic carbon, that is, carbon which can furnish graphitic oxyd. Amorphous and graphitic carbons would therefore appear to represent, not different conditions of carbon itself, but certain polymeric states corresponding with that element.

THE VARIABILITY OF PERSONAL EQUATION.

The interval of time which intervenes between the actual and the observed transit of a star, called the personal equation, varies with every individual observer, and is one of the most uncertain elements in chronographic determinations of longitude. It has generally been assumed that the value of this function of time is the same during an entire series of observations. Mr. William A. Rogers, Director of the University at Alfred, N. Y., has endeavored to ascertain whether the power of perceiving and recording does not vary in the same observer under different conditions, and has given the result of his investigations in the American Journal of Science, No. 141, in a paper "On the Variability of Personal Equation in Transit Observations." He gives a summary of about 8,000 observations of artificial stars, made of paper and centered upon fine steel wires placed in a vertical position, and so connected with a Bond Chronograph that, by means of electricity, the exact time of opposition was automatically recorded. By using this automatic record as a standard with which the observed time of passage could be compared, Mr. Rogers, Prof. E. M. Tomlinson, and Mr. H. E. Babcock, each made a series of observations from which it was determined that, 1. The personal equation is a varying quantity. 2. The probable error of observation is less for an abnormal than for a normal position of the body, which is contrary to what would seem a natural inference. 3. An exhausted state of the system produced a slightly favorable result in diminish-

ing the equation. 4. Hunger affects the value of the personal equation. 5. That the mental state of the observer has some influence on the personal equation. Mr. Rogers also gives a summary of his investigations to determine whether changes in the size, shape, or illumination of the object affect the power of the observer; in conclusion, he states that the results he found do not settle definitely any point except the general variability of the personal equation. We may, therefore, make the general statement that the velocity of thought in the same individual is not uniform, and that while we know that one will think slow or fast, it is still impossible to determine the causes which produce these changes in the speed of thought.

An item, read by the Chairman, relating to consuming smoke in furnaces elicited considerable discussion.

Mr. T. R. Pickering said that a smoke-consuming furnace was tried at the Dry Dock Iron Works in this city. It was Mr. Underhill's plan. Some years ago he had seen a single boiler forty inches in diameter, two feet long, with twenty square feet of grate surface at a level of only thirteen inches below the bottom of the boiler. The people of the neighborhood and the owners, were much annoyed by the large amount of smoke resulting from the imperfect combustion of the fuel. So another boiler of the same size was placed by the side of the other; the last boiler had a grate surface of twenty-five square feet, about five feet more than the other, but the grate surface was placed at a level of thirty-two inches below the bottom of the boiler, by which the space allowed for combustion was much increased; and as a consequence, the smoke nuisance was avoided, and a great economy in fuel was effected.

Prof. Phin remarked that the plan alluded to by the Chairman in his summary of news, was inefficient for the purpose, as the gaseous products of combustion carried back into the furnace would dilute the air and reduce combustion. And as the process becomes more perfect, the impurity of the air for combustion would increase until a point might be reached at which the fire would be extinguished. The great waste of combustible matter that passes off through the chimney is not carbon, but carbonic oxyd.

Mr. G. H. Babcock stated that an inventor from one of the western States came to Providence, Rhode Island, some ten years ago, and fitted an apparatus somewhat like the one here mentioned to the boilers of the Roger Williams Manufacturing Company. He applied a blower to take the smoke from the chimney and return it beneath

the grate to the fire. The experiment, in every instance, resulted in putting out the fire, and, of course, the thing was condemned.

Mr. J. K. Fisher said it was not possible to burn smoke after it was made; the carbonic acid acts like a damper and puts the fire out. A system of fuel-saving, in which the returning of the smoke, or part of it, to the furnace, was tried some years ago on a boat on the Hudson river. Mr. Stetson, who was employed to examine it, stated to the Polytechnic Association that the boat saved fuel and lost more money than any other boat. The return of all the smoke must necessarily prevent fresh air from entering the furnace, and the fire must go out; and a return of part of it must hinder combustion; and it is considered by experimenters in this matter, particularly by C. Wye Williams, that smoke once made cannot be burned. Sir Goldsworthy Gurney tried many ways to burn it, and succeeded only by first absorbing the carbonic acid from it by passing it through sand mixed with quicklime, a process impracticable for steam purposes. If, in some cases, it has appeared that smoke has been burned, it probably was because there was little or no carbonic acid, and much carbonic oxyd and hydrogen in it, as in the gases in Siemans' furnace; but to burn such matter is not to burn common smoke; it is in fact a deception which may mislead the inventor more than it can mislead ordinary practitioners. In reference to what has just been said, that in common practice double the quantity of air theoretically required is drawn through the grate, he would refer to the analysis of gases from the smoke boxes of locomotives by Ebelman and Sauvage. In passenger locomotives that worked with fires twelve inches deep, there was twelve per cent of air and no carbonic oxyd mixed with the normal products of combustion; and in freight engines that worked with fires eighteen inches deep, there was little air and so much carbonic oxyd as to indicate a loss of seventeen per cent of the fuel. These analyses indicate that with a forced draft, and the fires not too deep, a most perfect combustion, without much excess of air, may be attained by a skillful fireman; and any contrivance to burn smoke can have little use but to prevent waste by unskillful firemen or by ill-constructed apparatus. It is very seldom now that blue flame is seen coming from the smoke pipes of our steamboats, as they now use very thin fires, which does not make so much carbonic oxyd as a thick fire.

Prof. J. A. Whitney described a furnace lately invented, in which

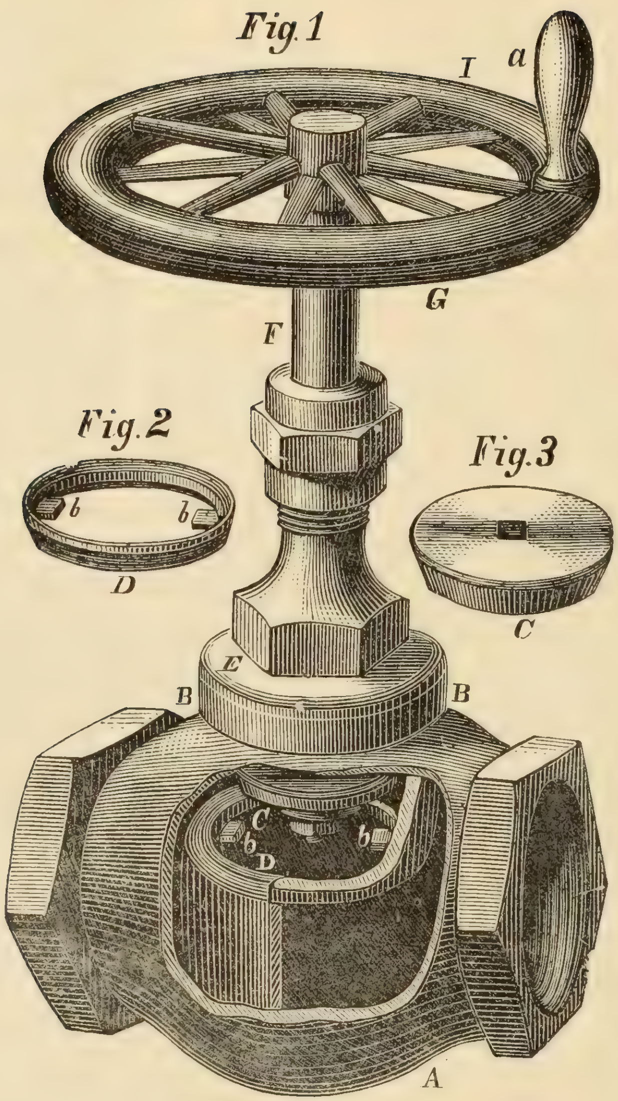
the fire-pot is suspended within a corrugated shell, the air passing between the shell and the fire-pot, combines with the fuel and produces an intense heat without smoke.

The Chairman remarked that some twenty or thirty patents have been granted on different plans for causing jets or minute streams of air to mingle with the hot combustible gases at their point of escape into the remote flues. Few, or none of them, however, appear to have proved successful in practice, or to have been adopted to any considerable extent.

Mr. G. H. Babcock stated that although smoke burning is a favorite idea with engineers, it does not always turn out the most economically when tried. In Milwaukie, Wis., a year ago, he experimented with very poor bituminous coal. By an arrangement similar to those mentioned by the Chairman, smoke was effectually prevented, but its removal, much to his surprise, while it resulted in the evolution from the fire of a large volume of smoke, gave twenty per cent better results from the fuel than before.

Mr. C. E. Emery said that the inventions mentioned by the Chair, are all founded upon the plan proposed some years ago by Wye Williams. He admitted air in small streamlets through the bridge wall of the furnace. It has since been shown that the useful effects of the air thus admitted is due chiefly to its mechanical action. The same advantages may be obtained by admitting air through perforations in the lining of the furnace doors. Experiments made in the United States Navy showed an economy of about three per cent from the latter plan, besides securing a reduced temperature in the fire room.

Mr. J. W. Cole remarked that within the past two or three years, experiments to produce a perfect combustion of anthracite coal were made with a furnace fed from the sides, with a thin layer of fuel, having an arch over the fire of fire-brick. Thinking that a saving could be made by the introduction of heated air, another arch was placed over the first, allowing the air to pass between the arches and be distributed into the fire in their sheets at the ends of the brick in the lower arch, the weights being taken of the fuel burned and the water evaporated, it was shown that no saving was made, but a similar furnace erected at the Sligo Iron Works, also at Pittsburg Water Works, in Pennsylvania, showed this device to be well adapted to a quite thorough combustion of the smoke. These furnaces seemed to prove that the most economical fires were made by giving not



BURT & TOWSLEY'S PATENT PERPETUAL GLOBE VALVE.

only the proper equivalents of carbon (and in bituminous coal also hydrogen) with oxygen, but in forming this combustion at a sufficient degree of temperature to produce a perfect ignition before permitting the flame and gas to be subjected to the refrigerating effects of the boiler. Is not this point, the requisite temperature for a perfect ignition, more worthy the attention of engineers than is generally supposed?

Mr. T. R. Pickering said his experience confirmed the remarks of Mr. Cole.

Mr. C. E. Emery stated that a forced draft makes a very hot fire and burns more coal; it requires, therefore, more heating surface to absorb the heat of the products of combustion. If the heat that passes up the smoke pipe of an ordinary boiler could be utilized in vaporizing water, and the draft be obtained by means of a blower, much saving of fuel would be effected. In a marine boiler some fifty-three per cent of the evaporation is due to the heating surface in the furnace alone. The surface near the furnace is nearly as efficient, and the remainder of the surface are less and less efficient, the further they are removed from the furnace.

Globe Valve.

Mr. Henry Burt exhibited his Perpetual Globe Valve.

Burt & Towsley's patent perpetual globe valve is always tight, and costs not half the sum of any other valve to do the same work.

Figure 1 represents the valve complete; figure 2 is a detached view of the interchangeable valve-seat; and figure 3 is a detached view of a duplicate valve.

The shell or globe, A, fitted for connections with the pipe-sections in the usual or in any suitable manner, has its neck, B, of such size that the valve, C, and valve-seat, D, may be passed through it into the globe. This neck has screwed into it the piece, E, through which is screwed the tubular valve-stem, F. Upon the upper end of this valve-stem is fixed the lower half, G, of a divided hand-wheel, and passing centrally through the valve-stem is a rod, upon the upper extremity of which is provided the upper half, I, of the double wheel just adverted to. Upon the lower extremity of the just named rod is fixed the valve, C, the latter being, of course, immediately below the lower end of the valve-stem itself, with which, in this manner, it is connected.

Globe valves are not worn out, but destroyed by hard screwing, which is unnecessary with our valves.

When worn out the valve-seat is changed by unscrewing, with a flat piece of metal pressed against the lugs (b b) the valve is changed by unscrewing the nut on the spindle.

To shut the valve turn both wheels.

To keep the valve tight, needs only to rub it to a joint when dirt intervenes between the valve and its seat; this is accomplished by turning the crank wheel (which revolves the valve, C), two or three times around, after placing the valve so as to just•touch the seat.

Comparison.—It cannot be denied that all the slide valves wear unequal on their surfaces by sliding, the bottom of the valve face and the top valve seat wears fastest; also, the current passing through the valve deposits dirt in the valve chamber, and cuts (wears) the valve seat, and when partially closed cuts both the valve and the seat; also, the backlash required to tighten the valves causes the current to toss the valve up and prevents graduating the flow. Again, when the valve seats are leaky, they must be put in the lathe and milled (faced) over again. The slide valve has a straight current or flow, but this is compensated for in the perpetual valve by having a large port, and the current wears the valve and seat equal all around.

Durability.—The valve is made durable by simply changing such parts as are worn (without unscrewing the pipe), and also by their being made of a material the least affected by *hot or cold grease*, *super-heated steam*, *chemical ingredients* in the water, oil works, sugar house, petroleum and alcohol distilleries, &c., for which purpose, this bronze metal has proved the best, all softer materials forming receptacles for grit, &c., to roughen the joint and make it leak.

When the duplicate valve and seat ring is destroyed others can be bought instead of buying the whole shell, wheel, &c., which will last much longer than the pipes, and saves taking down pipes to repair the valve.

Covering for Steam Boilers.

Mr. F. H. Snyder, of New York city, exhibited specimens of his improved covering for steam boilers, consisting of three layers of materials. The first layer is made of fire-clay; the second is composed of rye flour, saw-dust and charcoal, sometimes alum is added; the third layer is the same substantially as the first. The whole is coated with paint. An inch thick of this coating will stand the heat

of a furnace for three hours. It will locate a leak in the boiler by moistening the place. It expands about the same as iron. One hundred and fifty square feet, two inches thick will weigh 600 pounds.

Dr. D. D. Parmelee remaked that there was no better non-conductor of heat than plaster of Paris. The best way he found to use it was to saturate old newspapers with the plaster of Paris, and wrapping them around the pipe or boiler. Paper coated with plaster of Paris cannot be made to burn with a flame.

Mr. Norman Wiard said that Mr. Snyder's method of coating possessed the advantage of being a non-conbustible material (Mr. W. exhibited some of the belting used on the boilers at the fair, which, after a few days use, were converted into black charcoal). He had seen belting take fire of itself, and the engineer of the steamer St. John told him that on his boat it took fire twice.

Adjourned.

December 9, 1869.

Prof. S. D. Tillman, in the chair; C. E. Emery Esq., Secretary.

The chairman presented the following scientific notes:

Heat as a Measure of Chemical Decomposition.

M. Thomsen has a paper in Poggendorff's Annalen on "Thermo-chemical Researches," the purport of which is that different acids, when neutralized by the same base, evolve unequal quantities of heat. When, therefore, any acid displaces another acid from its combination with that base, this decomposition will be accompanied either by an evolution of heat or by an absorption of heat, according to the greater or less heat of neutralization possessed by the free acid or the acid of the salt. The quantity of heat thus evolved or absorbed affords a measure for the degree of decomposition.

The Solar Corona.

The result of the numerous observations of the Corona, made by American scientists during the late solar eclipse, are thus briefly summed up by a correspondent of The Yale College Courant: They demonstrate concerning the Corona: 1. That it is not flame, since the spectrum exhibits no dark lines. 2. That it is not reflected light, *i, e.*, light emanating from an incandescent body, and reflected by the particles of its atmosphere, because it is in no degree polarized.

3. Resting solely on the authority of Prof. Young, that it is identical in nature with the aurora borealis, showing in its spectrum three characteristic *bright* lines. Confirmation of its electric origin is found in its shape. It attains greatest extent in the direction of the ecliptic, and next greatest at right angles to that line.

The Sciopticon.

Mr. L. J. Marcy of Philadelphia has given this appropriate name to an improved portable magic lantern. It is illuminated by a double-wicked coal oil lamp, which is so arranged that the condenser and reflector will not become overheated. It has an improved receptacle for picture slides, and is well adapted to the production of advancing and receding phantasmagoria. Since the substitution of photographic transparancies for the coarse paintings formerly only used with the magic lantern, the instrument has assumed a new importance because the former when magnified reveal no distortions. The sciopticon, well supplied with photographic pictures of remarkable organic structures, beautiful scenery and specimens of fine architecture, will be prized in many a family as an unfailing scource of amusement and instruction.

Ligurian Bees.

The species known as the Italian Alp or Ligurian bee is indigenous to southern Europe. From time immemorial it has been fostered in Italy, but it was not introduced into northern Europe or this country until within the last ten years. Baron Von Berlespch, an eminent German apiarian, thus sums up their advantages: 1. The Italian bees are less sensitive to the cold than the common kind. 2. Their queens are more prolific. 3. The colonies swarm earlier and more frequently. 4. They are less apt to sting. 5. They are more industrious. 6. They are more disposed to rob than the common bees, and are more courageous and active in self-defense. They strive, whenever opportunity offers, to force their way into colonies of common bees; but when strange bees attack their hives they fight with great fierceness and with incredible adroitness.

Elephant Plows.

In India the elephant is made serviceable before a gigantic plow. The implement is guided by two men and turns up a huge ridge and forms a furrow three feet deep by four and a half feet wide at

the top. This is the deepest subsoil plowing we have any account of.

CURIOUS FACT IN ACOUSTICS.

The firing of the guns at the late meeting of the Highland Rifle Association at Inverness was heard distinctly, says a Scottish journal, as far as Cairnorm hills and in the forest of Abernethey a distance of fifty miles. The wind was favorable for carrying sound in that direction, and there is a steady rise in the ground nearly all the way.

TEST FOR ALBUMEN.

Dr. Méhu mixes in one part, by weight of crystallized carbolic acid or phenol, one part of commercial acetic acid and two parts of ninety per cent alcohol. In a case of albumenaria, to detect albumen, add to 100 grammes two centigrammes of commercial nitric acid, and after thorough mixing add ten of the carbolic acid solution. The reaction produced is said to be very superior to that in which nitric acid alone is used.

PLUMBAGO AS A LUBRICANT.

The Journal of the Franklin Institute says: "Every one knows that for heavy machinery plumbago is a good lubricant, but every one does not always think of applying it where it would serve best. It may be of value to some of our readers to know that a planer, whose bed-plate required the force of eight men to slide it when lubricated with the best ordinary material, was easily shifted with one hand when plumbago of good quality was applied.

A NEW RUSSIAN CANNON.

A twenty-inch gun, cast at Perm, has recently been tested under the direction of Maj. Gen. Pestitch, commandant of the Cronstadt artillery. The gun was fired 314 times; each projectile weighed ten hundred weight, and the charge of powder required was 130 pounds. The weight of the gun is about fifty tons; the recoil was seven feet; the initial velocity, 1,120 feet per second, and the percussive force at a distance of fifty feet about 10,000 tons. The official report states that this is the most powerful gun in Europe.

TANNED COTTON CLOTH.

The Paris Cosmos states that cotton fabrics have been treated with a solution of tannin in the same manner as hides are in the

manufacture of leather, and that the cottton thereby acquires greater strength, and better resists moisture and disintegrating effects. The Cosmos does not undertake to explain the chemical reaction which produces this important change. We suspect the change cannot be great, since it has escaped the observation of practical tanners. Those who are accustomed to wearing cotton clothes often saturated with tan liquor, as well as similar clothing untouched by tannin, would not be long in detecting and making known a new virtue in their favorite solution.

A Spring Motor to Drive Sewing Machines.

The first novelty exhibited before the Association this evening, was a sewing machine driven by a spring weighing forty-two pounds. It is the invention of Mr. F. Creamer, who claims that his combination is such as to give uniformity to the motions, which, without his appliance acts equivalent, would become slower as the spring became weaker; about six minutes would be required to wind up the spring, which would furnish sufficient power to run a sewing machine one hour. The object of this method of working the sewing machine was to relieve those who cannnot use their feet in driving treadle, and also to give greater freedom to the hands.

The machine exhibited did not verify the statement of Mr. Creamer regarding its power; but it was the first constructed, and had defects which could be easily remedied.

Mr. G. H. Babcock made the following remarks in relation to plans for driving sewing machines by means of springs:

Some eight or nine years ago this same subject came up before this Association. I had the honor of calling attention to the fact that some motor was required for driving sewing and other small machines for family purposes, and thereupon I was beset by numberless inventors, nearly all of whom proposed some form of spring power or clock-work. In order to set this thing at rest, I instituted a series of experiments to determine the amount of spring required to drive a sewing machine for a given time. I first found by trial that to drive a Wheeler & Wilson machine at the rate of 600 stitches per minute required some 550 foot-pounds, or one-sixtieth of a horse-power. This was a light-running family machine, the Wilcox & Gibbs only running lighter.

I then proceeded to ascertain by experiment how many foot pounds of work could be obtained from one pound of steel. This

of course, varied with different forms and sizes of springs; a flat spring of equal section giving the least, about twenty-five foot-pounds when strained to its extreme elasticity, and a small clock spring gave some 125 foot-pounds under similar circumstances. From a large number of experiments I came to the conclusion that for the style and size of spring which would be required for such work, forty-five foot-pounds was all that could be safely depended upon in actual use.

Now, as at least twenty per cent of the power of the spring would be used up in friction of the machinery required to transmit its power, it would take a spring capable of exerting not less than 690 foot-pounds to drive a sewing machine one minute; and this would require fifteen pounds of steel, or 900 pounds of spring, to drive a sewing machine for one hour; and 9,000 pounds for ten hours!

Again, the power of a strong man turning a crank is but 3,000 foot-pounds when working eight hours per day, but for a short time he can exert about twice that power, or 6,000 foot-pounds. It would, therefore, take him one hour and ten minutes to wind up a spring which would drive a sewing machine for *ten* hours. From these figures it is evident that no form of spring power is applicable to this purpose; and it is still a problem for inventors to furnish some simple and cheap motor for this and similar purposes where a small power only is required.

The Chairman remarked that according to the experiments of Mr. Babcock, it would require but seven minutes, to wind up a spring which would drive a sewing machine one hour; there are many cases, where this expenditure of power for seven minutes would gladly be made, to secure the operation of the machine for an hour.

However, he feared the statement of Mr. Babcock was too favorable. If a power is to be stored up for running sewing machines, the elevation of weights will be found most efficient.

Prof. J. A. Whitney remarked, that the running of the sewing machine has occupied the attention of inventors more than any other. It seems that few of them take into consideration that the more force that is used, the more weight is required. If fifteen pounds of spring is required to run a machine a minute, it would take 900 pounds of spring to run it an hour.

Dr. Vanderweyde stated that he had seen in Philadelphia a one horse steam engine run some thirty sewing machines, and the only objection the proprietor had to it was the cost of employing an engineer.

BATHOMETER.

Dr. A. W. Hall exhibited his bathometer for deep sea soundings. It consists of a tube closed at the top and open below, in which is inserted a graduated rod. As the instrument descends the increasing pressure forces the water up into the tube, compressing the air. The height to which the water ascends is known by its wetting a preparation covering the rod and leaving its mark; thus the depth is recorded. When the instrument strikes the bottom a weight is automatically detached, and the machine rises by means of a float attached to it. In instruments involving the principle of compressing air there is danger of collapse, even at a pressure of five or six tons to the square inch, where the pressure within and without the instrument is equalized as in this machine.

Mr. C. E. Emery suggested that the compressed air would be absorbed by the water to a greater or less extent, and thus cause inaccuracies in the record.

Dr. Vanderweyde thought that this difficulty could be overcome by covering the surface of the water in the tube with oil or similar fluid.

THE AURORA BOREALIS.

Dr. P. H. Vanderweyde said that a few weeks ago, the subject of the aurora borealis was under discussion, and a paper was then read by Dr. Hall, in which he contended that the aurora borealis is nothing but reflected sunlight. He, therefore, proposed to occupy their attention on that evening with some remarks in opposition to that theory, and in defense of the electric theory. That the aurora was the reflection of the sun is and old idea, and abandoned years ago. It was again debated by the great men of more recent times, and with the same result. The cause of atmospheric electricity is the evaporation of water, water containing salts in solution; and where such water is evaporated one part will be positively and the other negatively electrified. The vapor rising from the water will be positive, and the water below negative; and when these two electricities are combined, they neutralize each other. They have a tendency to neutralize themselves, and so we have the thunder storm. Some clouds may be stronger charged than others, but they influence each other. Our atmosphere is a non-conductor, and where this is overcome we have a flash of lightning. Sound travels 1,100 feet in a second; and so if it take ten seconds from the time a flash of lightning is seen,

and the sound heard, we can tell how distant it is. When it is a mile off, it will take five seconds, and at five miles we cannot hear the sound, the telegraph has proved this. The motion of the columns of light is very different from that produced by moving clouds, as every one will testify who has ever in his life seen such an aurora in its full brilliant display, with corona and luminous arcs; and that it can only be harmonized with electric action is known to all who are acquainted with the experiments of electricity *in vacuo.* The bows spanning the north, often seen, cannot possibly be explained as reflected light, or as the rainbow; this is beyond a doubt to all those who really understand the laws of reflection and refraction, which originate the rainbow, so well defined by Newton.

The columns of light sometimes seen shooting up in the west just after sundown, and in the east just before sunrise, and proceeding from the sun, are utterly dissimilar from the auroral beams. The gradual increase of auroral lights from nightfall till midnight, and their gradual decrease from midnight till morning, are not in harmony with reflections from the sun; while at twelve, midnight, the sun is the lowest under the northern horizon. If it is asserted that in the latter case the light is stronger, it is in contradiction with the increase of auroras in frequency and brilliancy as we go north. That they are unknown at the tropics, is an erroneous statement.

The fact that they produce no report shows only that they are not electric discharges like strokes of lightning; but that electricity noiselessly discharges through rarefied air, or through a so-called vacuum, is well known to all students of this branch of science. The asserted fact that in summer when the sun is further north, auroras should be more frequent and brilliant than in winter, when the sun is further south, is in contradiction with the argument of the reflection theory; and it is asserted that at twelve, midnight, the light is strongest, while the sun is lowest.

In regard to the relation of the aurora to thunder storms in summer, it must be observed that at the magnetic pole, where the aurora borealis always originates, it is nearly always winter. But the direct proof that the aurora borealis is by no means derived from the sun, is produced by the spectroscope, which does not show the lines peculiar to solar light, and in also to every object illuminated by the sun, but which in the aurora shows lines not seen in any other known luminous object. Moreover, Biot has proved that reflected light is always partially or wholly polarized; the auroral light, being not

polarized, is, therefore, not reflected light, but self-luminous. This is, however, only a proof of what it is not. A proof of what it is, and which makes its identity with the well known silent electric discharges *in vacuo* very probable, is, that it always proceeds from the magnetic pole; that the luminous beams passing high over our heads, from north to south, act on the compass needle, giving it an intermittent easterly or westerly deviation, exactly like an electric current would do after the law discovered by Oersted; and also that it induces such strong currents in telegraph wires that usually during the prevalence of an aurora, the electric telegraphs are worked by it, without batteries, which is another phenomenon perfectly in accordance with the laws of electric induction.

It is true that auroras occasionally do not affect the telegraph wire, but this is exceptional; they always affect the compass needle. This little instrument even indicates a coming auroral display, when during the day-time the currents are still invisible. Sometimes the aurora borealis has been seen during the day-time projecting its beams from the north while the sun was above the horizon; observations well authenticated.

Dr. Louis Feuchtwanger presented the following paper:

On Gold Mines.

The discoveries of gold in California, Australia and Nova Scotia have brought to light many important facts in the highest degree cheering for the welfare of the world; for experience has shown that mines which have been worked for the last twenty years have increased in richness many fold, and continue to with deeper workings. The oldest mine is Amadar; the North Star, the Albion, the Eureka and Haywards, are giving daily proofs; the latter, at a depth of 1,250 feet, is yielding the gold bearing quartz, and bringing the proprietor a daily income of $1,500, while the same mines at upper levels brought him to ruin; an assertion given by him to the writer a few years ago, on the journey from San Francisco. The Grass Valley mines, such as the Allison Ranch, particularly the Eureka, have increased in value from twelve dollars a ton to seventy dollars per ton, the latter being now 300 feet in depth. Nova Scotia furnished in 1862 but 7,275 ounces of fine gold, has, according to official reports, yielded in 1867, 27,290 ounces pure gold. Another important fact, the scientific miner has found that the widest auriferous veins are not usually the richest, and that some of the laminæ

running parallel with the drills are uniformly more productive than others; and it not unfrequently happens that a portion of the rock, sufficiently rich to be worked with advantage, is separated from another comparatively poor, bound by a distinct heading on false wall; that, as a general rule, the most productive veins contains a good deal of sulphide disjerminated. In 1862 the writer could have purchased 1,000 tons in Grass Valley of the sulphide tailings from one mill for twenty dollars per ton, which at present could not be had for $100 per ton; that, as a general rule, those veins which contains the sulphides in abundance, and prove so rich in gold, are situated nearer the surface, and having, after thousands of years, become decomposed, the inclosed gold has been liberated, and the quartz is found to be stained; but when gold occurs in a hard white quartz, free of sulphides, it is mostly in visible flakes and granules, not rich in veins; and though they afforded fine specimens in the early days of the gold producing, such veins are not often regularly and remuneratively productive. By taking the vein stone from a gold bearing rock, and examining the wall rock carefully, we will find that the latter has little furrows, as though the lode had been pushed upward, which indicate the direction the dip of the rich streaks. Sometimes gold occurs in nests and pockets apparently distributed without rule; at other times it is more uniformly disseminated by cross sections of veins; there is also great density; in one lode the metal is nearly all on one side of the vein, in another lode, similarly situated, it is chiefly on the other side, while in a third, but rarer case, it forms a plane or leaf in the middle of the lode.

Adjourned.

December 16, 1869.

Professor S. D. Tillman in the chair; Mr. C. E. Emery, Secretary.

The chairman presented the following notes on scientific progress:

New Crystallized Silver Amalgam.

From the Paris Comptes Rendus, we learn that at the government mint, in Bordeaux (France having two other mints, one at Paris and another at Strasbourg), there was left standing in an iron bottle a quantity of about ten kilos of that metal, which had been used to extract silver out of some refuse residues. On filtering chamois leather, there remained upon the filter a certain number of well-

defined crystals, which, on analysis, were found to contain, in 100 parts: Silver, 27.4; quicksilver, 72.6; and traces of gold. The native amalgam of these two metals contains, in 100 parts: Silver, 36; and mercury, 64; indicating that one atom of silver is united with two of mercury; while the crystals above alluded to correspond with the formula expressing the combination of one atom of silver with three atoms of mercury.

Use of Zinc-white as a Pigment.

Dr. Dingler, in his Polytechnic Journal, for September, 1869, disapproves of the use of any substances containing lead, along with zinc-white (oxyd of zinc), for painting. Instead of the ordinary boiled linseed oil, he recommends an oil prepared as follow: Two hundred pounds of linseed oil are gently boiled first, for five or six hours, alone; and next for twelve hours along with twenty-four pounds of coarsely broken-up peroxyd of manganese; in this manner a very quickly drying oil is obtained, which is eminently fit to be used with zinc-white or any other zinc colors. The oil so prepared should be carefully excluded from the air until it is required for use, in order to prevent its becoming too thick. The zinc-white should be first mixed with from three to five per cent of raw oil, after which the prepared oil may be added.

Perception of Color.

Experiments have recently been made in Germany to ascertain the relative time required to discern different colors. It was found that the color most easily and quickly distinguished is bright yellow, while those most difficult to recognize are the red and violet. Bright olive comes next after yellow in being readily perceived, and green seems to occupy a middle position. These experiments may have some weight with those who are devising signal lights to guide locomotion on land and water. Obviously the reason why red and violet are not so quickly perceived, is that they are at the opposite extremes of the solar spectrum, and extend respectively to the line where undulations cease to give any impression of light. On the other hand, the least sensitive eye should be most impressed, as that of the young child is, by the red, because it is produced by the longest undulations, which are also those of least velocity.

Dr. Vanderweyde remarked, that in the primatic spectrum the yellow rays, situated near the middle, are the most luminous, while

the red and violet, toward the end, are the least so. To the question why the setting sun looks red is answered that, by the law of refrangibility of the different colors contained in white light, the least refrangible rays, which are the red and orange, in a great depth of any colorless refracting medium, penetrate best in a straight direction. The more refrangible rays, the violet, blue and green, have a stronger tendency to sideway refraction, and this is the simple reason of the bright blue color of the sky and the dark blue color of water, if pure and of great depth. Divers, when under water, also see the sun red for this reason.

Another item on "Reflected Sunlight in Photography" elicited the following remarks from Dr. Vanderweyde: Photographs are taken in this city by reflected light, that is, a non-inverted ambrotypes and ferrotypes by means of a small mirror or reflecting glass prism attached to the front lens of the camera. Mr. Kurtz, photographer of this city, has produced what is called Rembrandt effects by means of light reflected by white surfaces. He, the doctor, had lately traveled a distance of thirty-six miles in the mammoth cave in Kentucky, and had some fine photographs which were taken there by the magnesium light.

Mr. S. Beer said he had taken very good photographs of basements and cellars by the magnesium light.

Reflected Sunlight in Photography.

Dr. H. Vogel, the German correspondent of The Philadelphia Photographer, after alluding to a new photographic light lately used in Vienna, which consists of oxyd of titanium, heated by a hydro-oxygen flame, says, he has lost much confidence in all artificial lights. His experience in the Egyptian tombs was the cause of it. In many of them he had burned large quantities of magnesium wire without arriving at any satisfactory result, and succeeded, finally, much better with reflected sunlight. An opening was made in a funeral vault; the rays of sunlight were caught by a mirror and thrown on the object. The effect was better than fifty feet of magnesium wire. By moving the mirror the light glides over the object, and in this way, he had copied wall-painting, dark corners, ceilings, etc. His example has been imitated. The photographer, Hammerschmidt, has recently taken the interior of the Church of the Holy Sepulchre, at Jerusalem; also, the Anointment Stone of Christ, in the same church, by means of reflected light. He has succeeded admirably where all former

attempts have proved failures. In all these proceedings, directly reflected light proved efficient. Lately Dr. Vogel tried to make a picture with double reflected light; the object was a gas machine which stood in a dark corner of the royal academy; it could not be reached by direct reflected light. He had to use two mirrors, and the rays, after a second reflection, had to be kept longer on the dark parts of the object than on the light ones. The lens was a steinheil aplanatic, No. 3, with the third stop; time, July 24, between three and four P. M. He found that an exposure of from eight to nine minutes was necessary to obtain a good negative. This goes to show how large an amount of actinic force is lost by reflection, as the same lens, with direct light, would have required an exposure of twenty-five seconds. In this connection he mentions the extraordinary difference in the actinism of sunlight, during different seasons of the year. For instance, under the fiftieth parallel of northern latitude, the intensity of light on the 21st of December, at noon, is only equal to the intensity at six and a half P. M. on the 21st of July. In this respect the photographers of the southern hemisphere have the advantage over us, as, with them, Christmas happens in midsummer.

The Colors of Foliage.

The London Athenæum says: "Experiment has confirmed the conclusion of an American scientist that leaves turn red, at the end of the season, through the action of an acid, since one of the elements producing the green color must be a vegetable blue. Autumnal leaves placed under a receiver, with the vapor of ammonia, in nearly every instance lost the red color and renewed their green. In some, such as the sassafras, blackberry and maple, the change was rapid, and could be watched by the eye, while others, particularly certain oaks, turned gradually brown without showing any appearance of green."

Oenoline.

M. Morat gives in a German journal the process for separating oenoline, the coloring matter met with in genuine red wines obtained from grapes. It is composed of ten equivalents of carbon, ten of hydrogen, and five of oxygen. Young red wines contain, moreover, a pigment soluble in acetic and batyric ethers, with a bluish violet color, becoming green by ammonia, and finally turning brown. Some chemists consider that this material is identical with cyanine; it is not a very stable compound, and is only found in young wines. The

coloring matter of wine is of some interest, as affording means for detecting adulterations and artificial substitutes of wine.

The Cause of Moisture in Silk.

M. Suida gives, in the Paris Cosmos, an account of his experiments for the purpose of ascertaining what causes silk to absorb small quantities of moisture, which, although not readily manifest to the senses, is easily detected by the hygroscope. It is a well known fact that crude silk is very hygroscopic, and some doubt has existed as to whether the exterior gum-like varnish of raw silk, or the interior fibroine, was the chief seat of this great avidity for moisture. The author has taken a certain quantity of one, and the same kind of silk (the avidity for moisture is by no means the same for all kinds of silk), a portion of which had been deprived of its natural gum, while another portion was in its native state. The result of a very carefully instituted series of experiments is, that the fibroine, that is to say, the essential silk fiber itself, and not its tegumentary parts, gum chiefly, are the seat of the hygroscopic properties of raw, non-dyed silk; the process of dyeing altering the fiber, also effects its hygroscopic properties. In 100 parts of natural yellow colored silk, according to Mulder's analysis, there are of fibroine, 53.37; gelatine, 20.66; albumen, 24.43; wax, 1.39; and coloring matter, 0.05. In 100 parts of white, native silk, fibroine, 54.04; gelatine, 19.08; albumen, 25.47; wax, 1.11; resinous and fatty matter, 0.30.

Cyanine.

According to M. Morat, the coloring matter of flowers consists, first, of cyanine, or a blue pigment; second, a pink or rose colored matter, in reality identical with the first, and only altered by an acidity of the juice; third, two yellow colored matters, xanthine insoluble in water, and xanthine soluble in that liquid. Cyanine is best prepared from the petals of violets or iris flowers; by means of boiling alcohol a blue solution is obtained, which soon turns brown, but is restored to its primative color by being shaken up in contact with air. In order to obtain the coloring matter in a pure state, the alcoholic solution is evaporated to dryness in a water bath, and the residue taken up with water, wherein the blue pigment is soluble, while fatty matter and resins are left behind; the aqueous solution is precipitated by means of acetate of lead; the ensuing green colored precipitate is decomposed by sulphuretted hydrogen, filtered

and washed; afterward the filtrate is evaporated to dryness in a water bath; the residue is exhausted with absolute alcohol, and the cyanine precipitated from its solution therein by means of ether. Cyanine does not crystallize, is soluble in water and alcohol, and insoluble in ether; acids turn it red, and alkalies green; it is a very sensitive re-agent for both. Reducing agents decolorize cyanine; oxygen restores the color. The red coloring matter of flowers is extracted in a similar manner, and, once isolated, exhibits characters identical with cyanine.

RESEARCHES ON RESINS.

M. Sacc, in a paper published in the Annales de Chemie et de Physique, gives the result of experiments with resins, embracing copal, amber, dammar, colophony or common resin, lac or shellac, elemi, sandarac, mastic and carnauba wax. All these resins fused quietly when heated, excepting amber, shellec, elemi, sandarac and mastic, which swell up and increase in bulk. Only the carnauba wax melts in boiling water; resin becomes pasty therein; while dammar, shellac, elemi and mastic agglutinate, copal, amber and sandarac do not change. Alcohol of eighty-six per cent strength dissolves neither amber nor dammar, but agglutinates copal partly dissolves elemi and carnauba wax, and completely dissolves resin, shellac, sandarac and mastic. Ether dissolves dammar, resin, elemi, sandarac and mastic; partly dissolves carnauba wax, makes copal swell, but does not dissolve amber and shellac. Acetic acid causes copal to swell, acts slightly on carnauba wax, but has no effect on the other resins. A hot solution of caustic soda (sp. gr. 1.074) dissolves shellac readily, resin with difficulty, but has no action on the rest. In bisulphide of carbon, amber and shellac are insoluble, dammar and resin are soluble, copal simply swells, while elemi, sandarac, mastic and carnauba wax are dissolved with difficulty. Oil of turpentine dissolves, readily, mastic, dammar, resin, elemi, sandarac, carnauba wax; it causes copal to swell up, but has no action on amber or shellac. Sulphuric acid of 1.83 specific gravity has no effect on carnauba wax; all other resins it dissolves and colors brown, excepting dammar, which becomes a bright red. Nitric acid of 1.329 specific gravity does not dissolve the resins, but colors carnauba wax straw yellow, elemia dirty yellow, and mastic and sandarac bright brown. Ammonia does dissolve some of these resins, but causes copal, sandarac and mastic first to swell and finally to dissolve; resin it dissolves very readily.

Enameled Iron.

Specimens of enameled sheet iron with colored lettering and pictures by means of a cheap process recently brought out in England. They were exhibited by Mr. B. Austin, one of the agents in this city. He said the enamel is put on with a brush, and is permanent, not glazed over. Signs, such as exhibited, have been exposed to the atmosphere in England for six and seven years without showing any deterioration. Any class of pictures can be produced by this process. The pictures are made by transfers, the colors are metallic oxyds, and are burnt in at about 2800 degrees. He exhibited a sheet of enameled iron which had been kept in nitric acid for four months which did not appear to be affected by acid perceptibly.

Dr. J. J. Edwards said that this was simply a good, practical, cheap process of the old system of enameling, using iron instead of copper. For interior work these enamels are very valuable.

Mr. C. E. Emery stated he had recently experimented with specimens of enamel, and found that some varieties of it would crack very readily, while others could be bent backward and forward without showing any fractures. The proportions and character of the ingredients used in compounding the enamel make a great difference with its elasticity. His experiments were more particularly directed to the enameling of the cylinders of steam engines. The cylinders were of cast iron, and were treated in the usual manner to two coats of enamel; the first of a softer, less refractory nature, simply filling the pores of the iron and forming a base for the glossy exterior coat. He at first put on several coats to get a thick vitreous surface. This was found to crack much faster than thinner coatings. The thick coating was desirable for the reason that the cylinders would spring out of shape when subjected to the high heat necessary to melt the enamel, and the wearing surfaces inside could only be made approximately true by careful grinding in a lathe. In some cases the outer coating was completely ground away and the under coat exposed. The steam did not dissolve the enamel proper, but attacked the inner coating. The thick enamel always cracked on the concave surfaces, but the arch form kept it in place a long time. On the flat surfaces the enamel adhered well, except when the steam struck its edge, and all difficulty of this kind was prevented by rounding the corners where the steam entered. The object in using the enamel in steam cylinders was to produce economy of steam and fuel by preventing the condensation which takes place on account of the differ-

ence in temperature to which the cylinder is subjected during the steam and exhaust strokes. The non-conducting coat was entirely successful in accomplishing this object, though further experiments are necessary in order to make the application practically successful on the wearing surfaces. If the enamel is made of the proper materials it is quite durable.

Dr. Vanderweyde remarked that the old way of enameling was to paint the enamel on. The invention here is based on the peculiarity of different metallic oxyds to form colored compounds with silicates; it was the way in which colored glass is made, glass painting was executed, porcelain and earthenware was ornamented. Only in this process the principle of the chromo-lithograph was brought in use, in order to produce cheap enameled-colored pictures without the continued labor of the artist. The pictures were first printed on paper with different metallic oxyds in place of colors, and were then uniformly brown, while the color intended is only brought out after the treatment with the silicate in the fire. The paper print is transferred to the porous silicate coating previously baked on the surface of the iron, in the same way as is done on earthenware and porcelain; it is then a second time exposed to the fire to bake the metallic oxyd in and burn the paper off; it is then covered with a silicate glazing and exposed to a heat of over 2,000 degrees Fahrenheit, when this glazing melts, giving the finishing treatment to the metallic oxyds, which then in their perfect combinations with the silicate, form the different colored compounds, as, silicate of manganese for purple, silicate of cobalt for blue, silicate of gold for red, of uranium for yellow, of iron for green and brown red, of copper for bright red and emerald green, of antimony for orange, etc.

RAILWAY HEADREST.

Mr. L. Dederick, of 35 Park Place, in this city, exhibited a headrest, designed to enable railway travelers to sleep in a car in a sitting position. It consists of an air-tight India rubber bag, shaped like a collar, which is inflated by the breath; at each end is a strap, terminating in a loop or ring. The collar is placed around the neck, back of the head, and rest upon the shoulders. The arms pass through the loops or rings, the straps of which are crossed in front. The weight of the arms acts as a counter balance to the head, which is sustained from all sides. The apparatus can be made so small that it can be put in the pocket when not in use. Some of these head-

rests are for summer use, made of cloth and stuffed with cotton batting, to accommodate persons who object to the smell of India rubber. This kind is stiffened with whalebone. There have been other appliances for this purpose, but the great objection to them has been that they required to be fixed to the back of the car seat, and also supported the person in an uncomfortable position.

Dr. A. W. Hall, now took the floor, and replied with eloquence to the remarks of Dr. Vanderweyde made at the last meeting, on "The Aurora Borealis." He did not aim to defend his own theory so much as to oppose certain statements made by Dr. Vanderweyde at the last meeting.

The chairman read in this connection, the following from an American journal:

The Secret of the Aurora.

A remarkable discovery has recently been made with regard to this strange visitant to our northern skies, so long a subject of speculation and mysterious awe to all thoughtful observers. Whence arise these lights which stream forth with such magnificence in high northern latitudes? What is the origin of the brilliant coruscations of rainbow hues which rise toward the zenith, and sweep over the heavens in glowing arches, spiral bands, and tongues of flame? What is the source of the illumination changing with every passing minute, sometimes lighting the sky with a radiance like lingering twilight after the setting sun, or the softer glow of the rising moon, or the full orbed splendor of the queen of night? These are questions which from the infancy of astronomy have possessed an absorbing interest to many minds. All former theories have been unsatisfactory, and the most profound researches have been unavailing in unraveling the mystery. But light is breaking in upon the darkness, and we catch a faint glimpse of the glory to be revealed, the discoveries which are to reward the efforts of the astronomers of the future.

The men of science are at work in solving the problem, and the spectroscope is the instrument which brings down knowledge from the clouds. The fact is considered by astronomers as settled that this beautiful apparition is closely associated with disturbances that affect the earth, and has an equally intimate relation with physical changes affecting not only the sun, but the whole solar system. The last great period of magnetic storm in the sun, which took place in 1859, was

marked by intense magnetic action on the earth, the whole electric system thrilling and quivering under the solar influence. This condition of excitement was immediately followed by brilliant displays of auroral light in both the northern and southern hemispheres Hence an intimate relation may be inferred to exist between the aurora, terrestrial magnetism, and the physical condition of the great central luminary of the system. Neither is the earth the sole recipient of this magnetic influence. It must in the same manner extend to every member of the system, and when the aurora is flashing in our sky, it is a grand and imposing inference that the same wonderful agent is illuminating the skies of our sister planets, throwing a redder glow over the surface of fiery Mars, flaming among the moons and stars around the huge circumference of Jupiter, beaming with milder light in the moonless night of Venus, or clothing with added lustre the grand system of Saturn. Its influence must also reach to those strange wanderers, always invested with a romantic charm, which visit us at distant intervals, and stretching their fiery tales across our orbits, or threading their eccentric course between them, depart—"on the long travel of a thousand years."

The most eminent physicists differed in their views as to the elevation at which the auroral light is suspended above the earth. Arago asserted that to attempt to measure the light of the aurora was as useless as to attempt to measure the height of the rainbow. Sir John Herschel, whose institutions have the power of prophecy, maintained that precisely the same laws of measurement might be applied to the aurora as to any object raised high above the earth. Finally, it was conceded that aurora light is undoubtedly to be ascribed to electric action taking place at a very considerable height where the air is very rare. Then followed the question, if something could not be learned by analyzing the auroral light as to the condition of that part of the atmosphere in which the electric action takes place.

Spectroscopic analysis was therefore applied to the light of a brilliant aurora, and the result was most surprising and unexpected. If the aurora were due to particles excited to luminosity by electric action the spectrum would have shown a rainbow-colored streak of light. Instead of this a single streak of colored light appeared. This indicated that the light is due to the incandescence of some gas through which the electric discharges in upper air take place. This was to have been anticipated, and a practiced chemist would have immediately detected the nature of the gas from the posistion of the

line. But the bright line on the spectrum of the aurora held a position which belongs to no known element; it does not exist on the earth. The experiments were carefully repeated by Angström, by Otto Struve, and by Mr. Plummer, always with the same result; we are entirely ignorant of the nature of the substance to whose incandescence, or illuminating power, the aurora owes its brilliancy.

Another still more remarkable discovery has been made. Ever since the discovery of the zodiacal light by Cassini, it has been an object of great interest to astronomers. Such men as Humboldt and Sir John Herschel sanctioned with their authority the theory in regard to it, that the appearance is due to the light reflected from a multitude of minute cosmical bodies traveling round the sun within the orbit of the earth. The zodiacal light shines so faintly that it was supposed its spectrum could not be rendered visible, and if it were, a reproduction of the common solar spectrum was confidently anticipated by the advocates of the theory.

Angstrom succeeded in obtaining the spectrum of the zodiacal light, and that also presents but a single line. This line is the identical line which is seen in the spectrum of the aurora. Therefore the gleam of zodiacal light, and the flash of the aurora are due to the same sort of electric discharge, taking place in the same medium and dependent upon an element which does not exist on the globe. Here we seem to hold the key for the explanation of many phenomena which have long been perplexing the scientific world. Comets give the spectrum of the incandescent vapor of carbon, indicative of intense heat even when as in Winneke's comet, they are farther from the sun than the earth is. The action of the sun in exciting electric discharges would solve this and similar mysteries. It has long been considered that the peculiarities of comets' tails were dependent upon electrical action. Euler asserted more than half a century ago that comets' tails have something in common with the aurora and the zodiacal light. We are safe in prophesying that the next long-tailed comet that sweeps our sky will have the devoted attention of all the celebrated physicists on the globe.

How stranger than any dream of a poet's fancy it would be, if the most mysterious phenomena which have puzzled the brains of the men of science should be discovered, at very nearly the same time, to be due to the same cause, the all-powerful magnetism of the sun, and that it is the manifestation of this wonder-working agent

which is revealed to earthly eyes during the solemn darkness of an eclipse, in the curving, petal-like flames of the far-reaching corona; which softly shines in the opaline lustre of the zodiacal light; which sweeps the heavens in the gauzy tissue of comets' tails; or which flashes in responsive light in auroral displays around the revolving planets.

The London Spectator in noticing the recent revelation of the spectroscope, that the spectric of the aurora borealis and of the zodiacal light are identical, says: "When once we recognize the fact that electrical action is effective in producing any of the celestial lights, we have a resource available to remove many difficulties." Then, noticing the difficulty astronomers had met in accounting for the combustion of carbon, requiring the most intense heat, in comets' tails, as in that of Wiennecke, it continues: "It is most probable that the first long-tailed comet which is submitted to spectroscopic analysis will establish the view which Euler set forth, more than half a century ago, that comets' tails have something in common with the aurora and zodiacal light. It would, indeed, be strange if three of the most mysterious phenomena with which men of science are acquainted should find their explanation simultaneously."

Adjourned.

December 23, 1869.

Professor S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The meeting was opened by the presentation of the following notes from the Chairman:

The Cuttle-Fish.

Mr. L. L. Hartt, in his "Chapter on Cuttle-Fishes" in The American Naturalist, describes his encounter with one of these octopods on the coast of Brazil, which wound its long arms, covered with numerous suckers, around his hands in such a way as to hold him prisoner for a short time. On relinquishing its hold it dropped on the sand, and, using its long slimy arms as legs, made its way toward the water, looking like a huge and very tipsy spider. The cuttle-fish belongs to the mollusks, a branch of the animal kingdom distinguished for its members being built upon the plan of a sac, and to which Mr. Hyatt has applied the more appropriate name of *Saccata*. It is distinguished from all other mollusks, such as snails, clams, &c., by

having a very large head, a pair of large eyes, and a mouth furnished with a pair of jaws, around which are arranged, in a circle, eight or ten arms furnished with suckers. In the common cuttle-fish or squid of our coast, the body, which is long and narrow, is wrapped in a muscular cloak or mantle, like a bag, fitting tightly to the back, but loose in front. It is closed up to the neck, where it is open like a loosely-fitting overcoat buttoned up to the throat. Attached to its throat, by the middle, is a short tube, open at both ends. This tube or syphon can be moved about in any direction. The animal breathes by means of gills, which are attached to the front of the body, inside the cloak, and look like the ruffles of a shirt-bosom. By means of these gills the air contained in the water is breathed, and they answer the same purpose for the cuttle-fish that our lungs do for us. In order to swim, the animal swells out the cloak in front, so that the water flows in between it and the body. Then it closes the cloak tightly about the neck, so that the only way the water can get out is through the syphon. Then it contracts forcibly its coat, and the water is driven out in a jet from the syphon, and the body is propelled in an opposite direction like a rocket through the water. This syphon is flexible, like a water hose, and can be bent so as to direct the stream not only forward, but sideways, and backward, so that the animal can move in almost any direction, and turn summersaults with perfect ease; and so rapidly do some cuttle-fishes swim, that they are able to make long leaps out of the water. Usually, however, the animal swims backward, with its long arms trailing behind. Our common cuttle-fish of this coast has, in addition to its eight arms, two long slender tenacles, which may be withdrawn into the body. The tail is pointed and furnished with a fin on each side. The octapods to which the Brazilian cuttle-fish belongs, have round purse-like bodies, and eight arms united at the base with a web, and they swim by opening and shutting their arms like an umbrella; in this mode of swimming they resemble the jelly-fishes. The paper nautilus is nothing in the world but a female cuttle-fish that builds a shell. There was a very pretty story told of her habits by Aristotle, the old Greek naturalist, which everybody believed until quite lately. He said she rode on the top of the waves, seated in her boat-like shell, and spreading her broad arms to the winds for sails. But, unfortunately, the story has no foundation in fact. She either crawls about on the bottom of the sea, or swims quite like other cuttle-fish, shell foremost, only occasionally coming to the sur-

face. Strangely enough, she holds the two broad, hand-like extremities of the arms against her body, and it is the inside of these arms that secrete the paper-like shell, which is only a sort of cradle for her eggs. Not so with the pearly nautilus, which is furnished with a beautiful coiled-up, pearly shell, formed on the outside of the animal. The shell is divided into numerous chambers, and the animal, living in the outer one, builds a partition across the back part of it as the shell grows. Cuttle-fish are sometimes used for food by the Brazilians, and different species may be seen in the markets, where one frequently finds them still alive. Sometimes as we stoop to examine one, its body is suddenly suffused with a deep pinkish glow. Before we have time to recover our surprise this color fades, and a beautiful blue takes its place as rapidly as a blush sometimes suffuses a delicate cheek. The blue, perhaps, is succeeded by a green, and then the whole body becomes pink again. One can hardly conceive anything more beautiful than this rapid play of colors, which is produced by the successive distention of sets of little sacks containing fluids of different colors which are situated under the skin. The cuttle-fish is also furnished with a bag containing an inky fluid, which, when the animal is attacked or pursued, it ejects into the water, thus completely blinding its adversary and effectually covering its retreat. It is from this fluid that the color *sepia* is made. Beside carrying an ink bottle, some species of cuttle-fish are provided with a long, delicate, horny pen, which forms a sort of stiffener to the back. In some species the pen is hard, thick and broad, and the cuttle-fish bone of commerce is of this kind. The species found in our waters is very small, and not at all dangerous, being barely large enough to draw blood from the hand; but in the tropical seas they are very large, powerful, and dangerous. The cuttle-fish is the original of Victor Hugo's devil-fish, so vividly described in the "Toilers of the Sea." If the devil-fish were a beneficent one, Mr. Hartt says he should be sorry to destroy our faith in it; but as it is, he believes it will be rather a relief than otherwise to know that in some important respects Victor Hugo's story of it is a fable. The kraken was a mythical cuttle-fish of fabulous size.

ASCERTAINING THE DUTY OF STEAM ENGINES.

W. Ashton and J. H. Storey.—A comparatively small cylinder is fitted with a piston, and is connected with the cylinder of the steam engine in such a manner as to allow the piston to be acted upon by

the pressure of the steam or by the force due to the continued action of steam and of a partial vacuum at the same times and to the same degree in proportion to its area as the piston of the steam-engine. The piston-rod of the indicator is connected with a spiral spring, which controls the action of the indicator-piston, the said spring resisting the movement of the said piston in either direction from the position of equilibrium, which is at about the center of the cylinder, the spring being made about proportionate to the area of the piston and to the pressure acting thereon. On the piston rod is mounted by a friction-wheel or pinion, to which a variable rotary motion is imparted during the working of the engine by a disk, the surface of which is in contact with the circumference of the said friction-wheel. The disk is caused to rotate alternately in opposite directions, the rotation being derived from the engine similarly as in the case of the barrel of the ordinary indicator, or in any suitable manner, the disk rotating to a suitable extent in one direction during the forward or upward stroke of the piston of the engine, and in the reverse direction during the return stroke thereof.

Mr. Emery remarked that this invention is of American origin, but it has defects which are obviated by more improved apparatus.

Mr. G. H. Babcock remarked that about four years ago he invented such an apparatus as was described. It is said to be a recent English invention. It is not new; it has, in fact, been invented several times. After he invented it, he found he had been anticipated. An indicator similar to it was exhibited at the fair of the American Institute in 1855 or 1856, invented by Mr. George H. Reynolds. It is not of much value, because of the inaccuracies developed by friction, the registering wheel requiring to be slid in the line of its axis, by the indicator piston. A good instrument that can be relied upon for this purpose is much wanted. In an early edition of Bourne on the steam engine, published in 1846, attention is called to this subject, and it is remarked that an instrument for this purpose would be very valuable. Some years ago Gooch invented one in which a series of diagrams was taken in succession upon a strip of paper, which had a regularly progressive motion. On the French steamers coming to this port this instrument is still used; but the area of all the cards must be computed to determine the power. Another invention for the same purpose, the inventor of which he could not then name, has been made, in which a ratchet-wheel received a series of impulses from a vibrating link, which was so connected with the piston of

the indicator that the impulses corresponded in length to the pressure in the cylinder at that instant; the sum of these impulses being registered by appropriate gearing. This was an approximate solution of the problem; but it gave the sum of inclined instead of vertical ordinates; and for this reason, as well as in the imperfect recording of the ratchet, was inaccurate. A perfect instrument for this purpose would find a large sale, as it would determine the average power exerted for any given time without the necessity of extensive calculations. It would be used to determine the power used for different processes, that used by tenants; and it would be possible with it to tell exactly how many foot pounds of force was exerted in driving a vessel from New York to Liverpool. The invention described by the Chairman is not what is really wanted.

Mr. J. K. Fisher said that about 1858 he invented an instrument just as described, and showed it at the Novelty Works in this city, with a view to get them to manufacture it. It was thought it would work well, but that the demand for such instruments was too small to warrant the outlay incident to the introduction of a new one. It was a combination of the steam indicator with a counting apparatus, similar to that in Morin's counting dynamometer. A plate is vibrated by the cross-head motion; against this plate a small friction-wheel is held by a spring-axle; the piston of the indicator pushes this wheel beyond the axis of vibration of the plate when the pressure is positive, and draws it within the axis when the pressure is negative, as in the case of a condensing engine on its back stroke. In case of a high pressure engine, the back pressure on the return stroke is deducted by the backward motion of the plate. It has been said that the friction of the wheel on the plate tends to prevent a true indication of the pressure; but it may also be said that the friction of the pencil on the paper has a like tendency, and probably may cause as much inaccuracy as would attend the wheel if the instrument were well designed and executed. The American Institute might find advantage in getting such an indicator to test engines at the fairs; using the common indicator and other test at the same time. As there is some inexactness in all known tests, it is well that they should be used to check each other.

Mr. Babcock remarked that Mr. Fisher's invention was one more added to the list of inventors of this instrument. But the opinion of the Novelty Works given ten years ago in regard to the demand for an indicator like this, would not hold good at the present day. The

"McNaught indicators" were being made at that establishment, and the demand was very light; but since we have the beautiful invention of Richards, the indicator is a necessity to every engineer, and they are made and sold by the thousands. So would it be with a good registering indicator, were it invented.

Translucent Mirror.

Dr. Adolph Preterre exhibited a translucent mirror, and distributed specimens among the audience. An ordinary glass plate is coated with a salt of platinum, and placed in an oven heated sufficiently to fuse it with the surface of the glass. The result is, that when an opaque substance is placed behind it, the glass will serve as a reflector or mirror, but without such backing the glass will be translucent. It was said that this glass was used in Berlin, Prussia, for windows, which admitted light in the day-time, and served as mirrors when the shutters were closed in the evening. The glass is manufactured by Faure and Dore, in Paris, France.

Mr. J. K. Fisher said that it has been discovered that all metals, when very thin, are transparent. Eye-glasses have been made on this principle; they are coated with a thin film of gold or silver, which mellows the light. These eye-glasses are used by the workmen to protect their eyes while at work in making the Bessemer steel.

Mr. G. H. Babcock remarked that this mirror had only a thin coating of platinum.

Mr. T. D. Stetson stated that there were many situations in which this method of coating glass would be valuable, as in places where it is desirable to reflect a portion of light and transmit another. For street lamps also, where most of the light should be thrown down, or along a dock.

Hall's Automatic Detachable Weight for Bathometer.

Dr. A. W. Hall exhibited his detachable weight for his Bathometer. It consists of a strong float balanced by means of an arrangement secured to the bottom, so that it will stand in an upright position about half out of water. The float is closed at the top, but there are holes at the bottom to allow the water to enter. If the air is absorbed by the water during compression, its place is supplied again by a small cup at the bottom filled with a very volatile vapor, such as chloroform, which would give off a gas or vapor. On the

top is a small lamp in which is placed some common resin, and when about to be used a small piece of phosphorus is put into the cup; this phosphorus will ignite the resin the moment the float comes to the surface.

Prof. J. A. Whitney remarked that, it is well known that where air is compressed, there is so much heat evolved, and so much power lost. Thus it would seem that it would work against the operation of the float.

Mr. Shelburne thought that the burning resin could be seen but a short distance on water, particularly in rough weather. If the weight of a diving bell was sufficient to sink it to the bottom, it would remain there, perhaps just touch the bottom; but if a portion of the weight of the bell was removed, it would commence to rise with considerable velocity. Therefore, beyond a certain depth, this instrument would not rise.

Dr. L. Bradley read the following paper:

AURORA BOREALIS.

By L. Bradley, M. D., Jersey City, N. J.

In treating the interesting and important subject of aurora borealis, I deem it necessary to premise by a general but brief examination of the phenomena, the causes and the effects of atmospheric electricity, in order that we may deduce, if possible, a rational theory of the essential nature of the aurora itself.

Atmospheric Electricity

Plays an important part in all atmospheric phenomena, either as a cause, a concomitant, or an effect. The formation of fog; the fall of rain and of snow; in storms, generally; in lightning, and in many phenomena which do not possess the character of lightning. Under the name of *Castor and Pollox*, the ancients designated the bright light which, in stormy weather, sometimes invests the projecting angles and the metallic parts of bodies.

Sailors tell us of St. Elmos fires, which sometimes appear at the mastheads and yardarms of ships, which, in extreme cases, make a peculiar noise, similar to that of electricity, where it escapes into the air under the influence of powerful tension. Cases are related in which soldiers and cavalry have seen fires shining on the points of their bayonets and swords. The spires of churches and other public buildings, are sometimes enveloped in a similar manner. Most

frequently these fires resemble, more or less, the brush, as of electricity in motion; but it sometimes happens that the light is concentrated into small globes, without any trace of diverging jets. These are, doubtless, of electricity in the opposite direction, or negative. But it is not only at the extremities of objects at the surface of the earth that luminous appearances are perceived in times of storms; sometimes fog, rain, snow and hail are decidedly luminous; but it is snow which most frequently presents this phenomenon, which is now taken as unquestionably due to electricity. The electric property of snow is so decided that atmospheric electrometers are sometimes powerfully charged during a fall. According to Beccaria, a cloud charged with snow, diffused in all directions a reddish light, sufficiently intense to enable one to read books printed on ordinary type. Frequently, people, in the midst of a storm, become foci of electricity, which is not only manifest by a light, but by a particular whizzing noise.

Brewster cites the case of two English travelers who, surprised in their descent of Etna, by a heavy fall of snow, accompanied by violent claps of thunder, heard a hissing noise every time they extended their arms into the air; and on extending a finger and moving it through this snowy atmosphere, in various directions and with rapidity, they were able, at pleasure, to generate a great variety of musical sounds, the intensity of which was such that they were perfectly heard at the distance of several yards.

I shall endeavor to show, presently, that *aurora borealis* is a phenomenon similar in its essential character to those above cited, and that all are due to what has been called atmospheric electricity.

Causes of Atmospheric Electricity.

Many hypotheses have been propounded to explain the origin of Atmospheric Electricity. Some have ascribed it to the friction of the air against the ground; some to the growth of plants, or to the evaporation of water; some have compared the earth to a vast voltaic pile; others to a thermo-electric apparatus. Some of these causes, and perhaps all, may concur, in some degree, in producing the phenomena. According to the theory of Peltier, the "electrical phenomena of the atmosphere are *entirely* due to the induction of the earth, which is primarily and constantly negative."

It is difficult for me to conceive how the earth should be rendered thus constantly negative, unless there be some force, constantly in

operation, adequate to such disturbance of the electric equilibrium between the earth and its surrounding atmosphere. Do not the potent rays of the sun, in their vaporizing effect, constitute such a force?

Pouillett and others have shown that no electricity is produced by the evaporation of distilled water, but if an alkali or a salt is dissolved, even in small quantity, there is chemical disaggregation and vapor is positively, while the solution is negatively electrified. The reverse is the case, if the water contains acid. Volta was the first to show that the evaporation of water produced electricity. Now, as the waters of the whole ocean hold salts in solution, Pouillett is disposed to see in this evaporation the source of atmospheric electricity. Desossure concurs with Volta and Pouillett in this theory.

I take it, therefore, as established that the vapor of the atmosphere as a whole, is charged with positive while the earth and ocean are charged with negative electricity; although the solid earth and the sea are, in some degree, in opposite electrical states; the sea being positive and the earth negative. It is also a fact, now well established, that the higher we ascend the more highly positive is the tension.

Bequerel and Peltier have demonstrated this most clearly; Quetelet, experimenting with a balloon and electrometer, satisfied himself, by a great number of observations, that the electric intensity of the air, increases proportionately to the height. I venture therefore to suggest the probability, that if an insulated conducting wire were to be erected, having a ground connection in a valley, and being connected with a large surface of wire gauze, above the top of a neighboring mountain, so as to form a good atmospheric connection, a current would be, at most times, propagated through the wire sufficiently intense to operate a Morse telegraph, and that the higher the mountain the more intense would be the current. The intensity will be variable, however, according to the hygrometic condition of the atmosphere.

A positive cloud, too, coming near the upper portion of our telegraph line, may change its electric condition by induction, so as to neutralize the current, or even to cause it to flow in the opposite direction.

EVAPORATION.

According to the learned Dr. Buist, as quoted by Lieut. M. F. Maury, in his physical geography of the sea, page 11, the average evaporation from the ocean equals about nine feet of water per annum;

i. e., a stratum nine inches thick per month. This, when evaporated, would give a stratum of steam at 212° Fahrenheit, and under ordinary atmospheric pressure forty-three feet in thickness per day, to be formed and condensed.

This, if I have figured correctly (supposing the sea to cover 150,000,000 square miles, and a cubic foot of water to weigh sixty-two and a half pounds), amounts to 2,157,463,500 of tons to be evaporated per minute. This vast amount is diffused daily through the atmosphere.

Now, if the smallest evolution of vapor from salt water gives an effect, appreciable by the electrometer, is it not surprising that in the formation and condensation of the immense amount shown by these figures, we do not encounter infinitely more of visible phenomena than we do?

We have now seen that the atmosphere is constantly charged with positive electricity, furnished by the vapors that arise from the sea, and that the earth is negatively electrized.

Tropical Currents.

In the tropical regions, where the water is most salt, and evaporation most abundant, there is an upward current which carries the vapor to a great height, and then, setting out both north and south, constituting tropical currents, which descend in proportion as they reach the higher latitudes. On reaching a region sufficiently cold, precipitation of snow, or of ice in some other form, takes place, in which electrical phenomena are almost sure to appear.

Under the tropical currents are boveal and austral currents, on their way to take the place of the ascending heated air of the tropical region.

The enormous amount of electrified vapors, rising high in the torrid zone, and men descending as they approach the poles, come in contact with many conflicting conditions in the atmosphere strata which underlie them, so that the neutralization of their positive electricity is allowed to occur very differently at different times and places, and under different circumstances.

All these are comparatively local, and are variable according as they are over the ocean, the land or fresh water lakes, and according to variations of temperature and the different electrical conditions met with.

In many regions of the temperate zones vapors arise which are

negative compared with those of the superincumbent tropical current.

Hence arise the many meteorological phenomena in which atmospheric electricity plays so important a part, and in which we sometimes witness the most terrific consequences.

STORMS.

The violent phenomena with which we are most familiar are storms with rain, lightning and hail.

Every particle of cloud or fog is known to be positively electrified, and to exist in the form of a small spherical balloon, in which a small pellicle of water serves as an envelop to the interior air. This may be verified by any one who will let some of the particles fall upon a slip of glass and submit them to microscopic inspection.

Now this covering of water possesses all the positive electricity which was distributed in the vapor which composed it. The size of these vesicular globes is maintained at the point of balance between the repulsive force of the electricity and the cohesion of the water.

When such globules, in infinite numbers, collect to form a cloud, is, as it were, a conductor, all of whose electricity is at once transferred to the surface; on the contrary, the globules preserve their insulation and their individual electricity, and do not part with it except in a manner very slow, according as the interstitial air may be more or less conductive.

In this way some of the electricity of the interior globules does slowly approach the surface of the cloud, thus enabling the globules individually to contract and severally to coalesce, forming drops, which fall carrying their remaining electricity to the earth.

Presently a high degree of tension is acquired at the surface of the cloud, near the negative earth, or near an adjacent cloud which has been rendered negative by induction, and a discharge takes place in the form of a flash of lightning. This makes way for still further discharges from the interior globules, and facilitates a more liberal formation of the rain drops.

I have often observed the sudden increase in the torrents of rain commencing in a few seconds, and continuing for a few seconds, after a heavy clap of thunder.

One clap follows another, and another, but such discharges never deprive the cloud of the whole of its electricity, for as soon as the excessive tension of the surface is so far reduced as to admit of the

collapse of the little balloon, they commingle, form drops, and fall, and in this way a large portion of the positive electricity of a cloud is carried silently to the earth.

At every disruptive discharge a disaggregation of matter must occur, or no light can be evolved.

In the case of every flash of lightning a portion of the vapor of water is resolved into its elements, oxygen and hydrogen.

The oxygen unites with free nitrogen of the air and forms nitrous acid.

The hydrogen unites also with the nitrogen to form ammonia.

The nitrous acid and ammonia unite, forming nitrite of ammonia. This salt is dissolved in the rain drops; is absorbed in the ground; imbibed by the roots of plants; then passed into other combinations by the leaves and other organs; then it appears in the fruits; then is eaten by animals and men, thus aiding to form their bodies.

In this we have one of the many beautiful and mysterious agencies employed by the Great Supreme Intelligence, in the wonderful works of creation and providence.

Ozone, too, is formed at every discharge, the importance of which, in the economy of nature, is not so well understood.

The phenomena and effects of a common thunder shower, as given above, are simple, compared with those of many great storms.

In order to understand the electric action and movements of clouds, we must be familiarized with the idea of the *individualities* of the globules and of the other constituents of which the clouds are composed.

The globules are grouped into flakes, having their limits and their sphere of action like the globules themselves; the flakes in grouping form mamellæ; these, in their reunion, form a cloudlet, and the cloudlets form definite clouds; the grouping of definite clouds forms a cumulus, and several cumuli form a nimbus, or rain cloud.

By regarding in this manner the electric state of the clouds, which is in accordance with observation, we are enabled to comprehend their enormous power of attraction in some cases, and the other phonomena which they present.

It is easy now to conceive how rain or snow are found to be charged with an electricity which they carry with them in their fall.

Each drop or flake must possess the electricity which was possessed by the globes which formed it; we can see also how snow or other

particles of ice in the atmosphere may, under certain circumstances, become luminous.

The electrometer sometimes detects negative electricity in cloud and in rain, snow and hail; but M. Palmier and others now think that this is only an effect of induction, and that no cloud can be intrinsically negative.

Every positively charged cloud must have a concentric region about it, which is made negative by induction, and it has happened that persons have been killed by lightning, or rather by what is called *return shock*, in a clear atmosphere, in consequence of such induction.

This is a phenomenon, easily explained.

When a storm cloud is powerfully electrified positively, and a person is situated within its sphere of activity, he becomes powerfully charged by induction with negative electricity, the natural electricity of the person being decomposed and the positive repelled into the earth.

Now, if the cloud is suddenly discharged by any means, and deprived of a large portion of its positive electricity, the natural electricity of the person is just as suddenly restored, and the shock may be such on the nervous system as to destroy life.

Brydon has related a remarkable case of this kind, in which a man named Lauder, who was driving a coal cart, was killed, together with his horses, where the sun was shining and no rain was falling in the neighborhood; but a heavy clap was heard at the time by others, from a cloud not far distant.

Beside this phenomenon of *return shock*, there are lightnings of three distinct kinds:

FIRST.—ZIGZAG OR FORKED LIGHTNING.

These present themselves under the form of a thin trail of white light; very defined; sinuous in its course; able to divide into two, and more rarely, into three branches; directing themselves generally toward the earth, but frequently they dart from one group of clouds to another.

The clouds and the earth, or two oppositely electrified clouds, correspond to the coatings of a leyden jar and the intervening air, the glass of the jar; the thunder storm is a charging and discharging of a huge system of this kind. The zigzag and forked conditions are undoubtedly due to the resistance which the discharges encounter in the strata of air through which they pass.

SECOND.—SHEET LIGHTNING.

Lightnings of this class present a light, which, instead of being concentrated into lines without apparent breadth, embrace on the contrary, immense surfaces.

They have neither the whiteness nor the vivacity of forked lightnings; are more sluggish, occupying appreciable time in their discharges; their tint is generally of intense red, though other colors sometimes prevail. Their bright light sometimes embraces the whole superficial extent of a cloud, and even of a whole group of clouds; at others, only part of a cloud, or the border; it is frequently undulatory and flickering. The discharges appear to be interstitial, darting among the globules or ultimate vesicles of the cloud, which seem to serve a purpose in some way resembling the metallic particles of the spangled pane of the lecture room. Sometimes the discharges appear to be made among the larger individualities of the cloud, and are exhibited in great numbers of interior flashes and zigzag flames of red light following each other in almost continual succession.

The lightnings of this second class are the most numerous of any, and are especially interesting on the present occasion on account of the analogy existing between their genesis and that of *aurora borealis.*

Silent flashes of lightning are frequently seen along a cloudless horizon, formerly called *heat lightnings.* Since the establishment of the telegraph, we learn that they are the lightnings of real storm, so far away as to be entirely below the plane of the horizon and too far off to be heard.

THIRD.—BALL LIGHTNING.

Lightnings of this class are much less numerous than those of any other, and are by far the most difficult of comprehension, having never been satisfactorily accounted for. They are veritable globes of fire, several inches in diameter, and are transported from the cloud to the earth with sufficient slowness to be distinctly followed by the eye, being visible for two or three and even for ten seconds.

They sometimes divide and rebound upon the ground several times; sometimes they burst, causing the detonations of heavy ordnance.

They sometimes enter dwellings, barns and out-houses, enveloping the whole building in flames in an instant.

They seem so pay no regard to conductors either good or bad.

Great and Violent Storms.

As to the causes, and the modes of generation of the great and violent storms, I will suppose a case, which with modifications, may be taken as analogous to a majority of those which do occur.

In the torrid zone, and during the hot seasons in the temperate zones, a sultry heat with a tranquil and humid atmosphere, may be taken as a precursor of storm. This may continue for days; the power of evaporation, being great, the air becomes more humid, and, as Tyndall, Melloni, and others have demonstrated, humidity is a powerful asborbent of heat; it is, in a measure opaque to the heating rays; it therefore, absorbs largely the sun's ray, as well as the radiant and reflected heat from the earth. The more the air is heated the more its capacity for aqueous vapor is augmented, and the greater is the absorption of heat. But although vapor absorbs heat it radiates it also. Whence then can it radiate?

The lower stratum is superposed by strata which are saturated too; it may, therefore, radiate into vapor, but the vapor radiates into it, also. The tendency then is for the air to retain its high degree of heat; to become rarified, and to rise; and from some quarter cooler air must come in to take its place. What then must occur in our ascending column of heated, humid air? For a time the radiation is intercepted, and, in great part, returned by the surrounding vapor; condensation under such circumstances cannot take place. But the quantity of aqueous vapor naturally diminishes as we ascend; its tension diminishes more rapidly than that of the air, and at length the humid stratum finds itself above the protection which had overspread it, and in the presence of purer space, where it pours its heat into, and with but little return from, the interstellar ether. This free radiation into space, together with the chilling effect due to the expansion of the ascending air, affords ample physical cause for the condensation of vapor and the generation of clouds. Cumuli are now formed, a stratum of which may extend over a large surface. Each visible cumulus forms the capital of an invisible pillar of saturated air. To take an extreme case, let us suppose that the sky being now overcast and the process of cooling going on more rapidly, another stratum is formed lower down than the first, and then another still lower. Cases are on record in which not less than three such strata have been distinctly observed. Now, let it be remembered that each stratum, in its relation to those above or below, maintains its own independent insulation and electric individuality, the same as do the

several clouds, cloudlets, or globules, as mentioned before, and that several individualities charged with like electricity, repel each other; but no one can be so repelled as to impinge, unduly, on those beyond it; all are maintained in equilibrio in the mass, which, by their agglomeration, they help to compose.

Now it must happen that all the individualities of *every grade* become, as it were, polarized for the reason that, above them *all*, is an atmosphere highly positive, and below them the earth which is negative. The positive atmosphere induces negative electricity in the upper portion of the upper stratum, driving the positive into the lower portion by which its normal tension is largely increased; this acts in the same manner upon the next stratum below. The negative earth, too, is acting to produce the same effect upward. It induces positive tension in the lower portion of the lower stratum, and that in the lower portion of the next, and so on.

Under such a system of actions and reactions among the several individualities between the negative earth, and the upper positive atmosphere, the surface of the earth must become endowed with a negative tension very far beyond that which is natural or common, and the lower portion of the lower stratum must also acquire a positive tension far beyond what it could possibly attain, if it were not so largely reinforced by the strata above.

They all act, like so many spans of horses, one before another, drawing in the same direction. The amount of lifting force then, exerted by such a stupendous magnetic battery, which in some cases may act, nay, does act, upon a single square mile of earth, it is scarcely within the scope of the imagination to conceive; it can be estimated only by millions of tons.

All loose substances, as well as trees, buildings, &c., are rendered powerfully negative, and are, therefore, repelled by the negative earth, while they are powerfully attracted by the superincumbent cumuli. Now we can see the *rationale* of those remarkable phenomena, the *raz de mareé*, in which the sea is raised to the height of three or four, and even to six or seven feet. They consist in the changes of level that are suddenly manifested without there being anything that can cause them to be anticipated.

Burtrand was the first to conceive and to explain that it was by the attraction of electric clouds that the waters were thus raised. We can now see why it is, that sometimes when a heavy cloud is hanging over us, the leaves, dust and other light substances when agitated by

the slightest breeze, seem to have lost their gravity and to rise high up without any apparent cause adequate to the production of any such effect.

The disastrous and terrific work of tornadoes, cyclones and water spouts, is now accounted for in which a slight gyratory behavior of conflicting winds is augmented into a force to tear up trees and carry them to great height; lay waste buildings and unmast ships; to carry up vast columns of vesicular vapor, and sometimes even whole water; emptying ponds of their contents, giving rise to those showers of solid substances, sometimes even living ones, such as frogs and fishes, which are noticed from time to time.

The great snake story of Illinois, said to be the greatest on record, reported in the Illinois State Register of June 1st, 1869, and copied in the New York Sun of the 6th, is remarkable. We are told that after a fearful tornado which occurred on Friday night, May 28th, every ditch, brook and pool on the prairie, north of Taylorville, was literally alive with nondescript reptiles, some of which were from one and a half to two feet long. Whether this be fact or fiction, it is, to say the least, plausible.

And now while writing, the Louisville Commercial of January 19, 1870, brings the account of a terrible tornado which occurred on the morning of the 17th, before the break of day, at Cave City Ky., a town of 400 inhabitants, in which nearly the whole was laid in ruins; fifteen persons killed and twenty-five seriously injured. In this, trees, ten to twenty inches in diameter were wrenched up by the roots, some were twisted into fantastic shapes, splintered and strown about, others were carried bodily hundreds of feet, buildings were torn to pieces and scattered like chaff, leaving not a vestage to mark the place of once peaceful and happy homes. A house was struck; violently turned around; struck again, and almost instantly leveled to the ground. The furniture disappeared entirely, was smashed to pieces, borne on the wild winds beyond the limits of the town. The bursting and detonations of ball lightning were of remarkable frequency during the passage of this *cyclone*, which extended some ten or twelve miles.

In the formation of two or more distinct strata of clouds, as described above, is to be found the condition which, according to most philosophers, is indispensable to the formation of hail. It is known that water, under some conditions, may remain in a liquid state at a temperature many degrees below the freezing point, and

that it may instantly congeal under some mechanical agitation. Now the water at the upper surface of a cloud may be in such a state. We can, therefore, see how aggregation in the form of sheet falling from a superposed stratum may produce the necessary agitation, and thus become immediately coated with a laminated covering of ice, forming hailstones. But I will not dwell further on this complex subject.

Aurora Borealis

Is a phenomenon which I take to be as fully due to atmospheric electricity as are any of those before considered.

According to the testimony of all observers, this phenomenon is always accompanied by a peculiar *haze* or *veil*, which, although allowing the light of the stars to pass, gives the sky a sombre aspect. This haze is known to be composed of fine transparent needles of ice.

M. M. Bixio and Baral, who, being raised in a balloon to a great height, found themselves, on a sudden, although the sky was serene and the atmosphere cloudless, in the midst of a perfectly transparent veil, formed of a multitude of little icy needles, so fine that they were scarcely visible. Dr. Richardson, in a temperature of fifty-seven degrees below freezing point, having seen an *aurora*, the arch of which was near the zenith, remarked that, although the sky appeared perfectly serene during the display, a fine snow was falling, scarcely perceptible to the naked eye. At another time he witnessed a similar fact under a brilliant sun, the rays of which permitted him to distinctly see the transparent icy needles. Gisler says, that in Sweden, upon the high mountains, the traveler is sometimes suddenly enveloped in a transparent fog of a whitish grey color, passing into green, which is transformed into an *aurora borealis*. When such haze or particles of ice are precipitated from vapor highly electrized, the electricity becomes free and luminous, as was the case in the snow cloud described by Beccaria. We are led to the conclusion, therefore, that the *aurora* arises from electric discharges, which take place between the luminous icy particles suspended in the air, and which, in infinite numbers, communicate with the earth or moist air below.

The arch from which the aurorial streamers are seen to radiate, is the boundary between the cold region occupied by the icy needles, and the milder region of moist air in which the discharges cease to be luminous. We may suppose that the production of *aurora* in the arctic and antarctic regions should be the normal state, and of daily

occurence, in which the establishment of equilibrium between the great tropical current and the earth should be manifested. And so it would, were it not that this great current has met with many interruptions, and been often arrested in its regular course by such disturbances in the underlying strata, as I have before mentioned; so much so, indeed, that whenever any portion of it is transported to the polar regions, it forms rather the exception than the rule. But occasionally it does, in part, reach the high latitudes, and then *aurora polaris* can scarcely fail to appear.

These icy needles, generated in a region of intense cold, are peculiar. Unlike the congealation of sleet and hail, or the crystallization of snow flakes from particles of water, they are precipitated directly from the transparent vapor without its passing through the intermediate liquid state. Like the ultimate vesicles and other individualities of a cloud, they maintain their own independent electrical spheres, and not only repel each other, but are, from their very inception, polarized.

The molecules of the vapor, too, of which they are formed, I infer, were polarized, and were, therefore, forced to unite in the exact manner to give them their peculiar filamentous or needle like form. Being precipitated from vapor, intensely positive, they themselves are endowed with positive electricity equally intense.

How then must they dispose themselves, in their relation to each other, when floating freely in the air? Certainly in parallelism, and with their positive poles directed toward the negative earth; therefore, when discharges between such haze and the earth, or the lower stratum of moist air become visible, they must appear in lines parallel with the direction of the icy needles. How beautifully apparent, then, is the *rationale* of those splendid displays; the flickerings, the streamers, the *corona* and the *merry dances*, all moving in exact obedience to the slightest electric or atmospheric changes. But

TERRESTRIAL MAGNETISM

has an effect, in a way, not yet well understood, in modifying and giving direction to the auroral movements. The well known effect of a magnet upon the electric arch between the poles of a powerful battery, and upon discharges through rarified air, are supposed to present some analogy to this terrestrial magnetic effect.

We are now obliged to discard the idea of extra atmospheric aurora, as well as that of reflected solar light, and must admit that

the phenomenon is confined to the regions where haze and cirrus clouds are wont to form; and from the abundant evidence we have of their frequent presence in regions very low down, we are relieved from the necessity of supposing that the rarity of the air in the high regions is indispensable to the transmission of *aurora*, although we know that the more rare the air (within certain limits) the greater is the facility offered by it for the transmission.

AURORA NOT HIGH UP.

In proof that Aurora may not always be high up, I quote the following: "Captain Franklin saw an *aurora borealis*, the light of which appeared to him to illuminate the lower surface of a stratum of clouds; whilst twenty-five miles further on, Mr. Kendal, who had watched the whole night without losing sight of the sky, did not perceive any trace of light."

"Captain Parry saw an *aurora borealis* display itself against the side of a mountain."

"Lieut. Hood and Dr. Richardson, being placed at a distance of about forty-three miles from each other in order to make simultaneous observations, whence they might deduce the parallax of the phenomenon, and, consequently, its height, were led to recognize that it had not a greater elevation than five miles."

Finally, "M. Liais, having had the opportunity of applying a method of his to the measurement of an *aurora* seen at Cherbourg, October 31, 1853, found that the arc of the *aurora* was about two and one-half miles above the ground at its lower edge."

THE NOISE OF AURORA.

The whizzing, or noise of crepitation, often heard by observers, in high latitudes, although denied by some learned philosophers, present to my mind ample evidence of the low position of many *aurora*.

I quote further:

"M. Verder, on the night of October 13, 1819, being in the latitude of Newfoundland, heard very distinctly a sort of crackling noise or crepitation, when the building that he ascended was in the midst of an *aurora*."

"It is generally admitted by the inhabitants of the northern regions, that when the *aurora* appears low, a crackling is heard, similar to the electric spark."

"M. Ramm, inspector of forests in Norway, wrote M. Hausteen

that he had heard the noise, and that it always coincided with the luminous jets."

"Dr. Gisler, who for a long time dwelt in the north of Sweden, remarked that the matter of *aurora borealis* sometimes descends so low that it touches the ground; at the summit of high mountains, it produces upon the face of the traveler an effect analogous to that of wind." Any one who has placed his face or a hand, near an intensely charged prime conductor, cannot fail to understand the nature of the effect here spoken of.

"Dr. Gisler adds, that he has frequently heard the noise of *aurora* and that it resembles a strong wind, or the whizzing that certain chemical matters produce in the act of decomposition."

If the elective discharges through the haze are interstitial darting from needle to needle, as they, undoubtedly are, we cannot doubt that such crepitation would be observed by persons near enough to hear it.

THE ODOR OF OZONE.

The pungent odor spoken of as observed by some who have heard the noise, goes far to strengthen the evidences here cited. This odor is undoubtedly that of ozone, which is evolved, as well in the infinitesimal discharges of *aurora* as in flashes of lightning; it is represented as identical with that observed at the discharge of a powerful leyden jar, and is, without doubt from the same cause.

In view of the foregoing evidence, it seems to me that there must have been some fallacy in the parallaxes which have placed *aurora* at the great heights of four, five and six hundred miles, for, at such elevations, there is no appreciable atmosphere, or, at most, it is too rare to sustain clouds or haze of any kind.

Is it not probable that the appearance presented by a haze in a given region may change, according to the point from which it is observed, or, may it not present an *aurora* at one point and be dark at another? Might it not have been so in the case of Franklin and Kendall, above quoted?

Arago held that to attempt to measure the height of an *aurora* was as futile as to attempt to measure the height of a rainbow. It is indeed certain that, in some points of view, each observer does see his own *aurora borealis* as he sees his own rainbow.

Electric Storms.

Aurora borealis has so generally been accompanied and preceded by great disturbances of the magnetic needle, that it has been called a magnetic phenomenon; and the general operation which causes such disturbance, as well as the remarkable effects upon the telegraph wires, in sometimes neutralizing, and at others greatly augmenting the force of the battery current, has been called a magnetic storm.

I prefer to call it an *electric storm*, for it is no more nor less than an operation of atmospheric electricity, moving in alternate and varying directions.

Electricity passing a magnetized needle, in any direction except in a line directly transverse to the magnetic meridian, always causes it to diverge more or less, as when a current passes through a galvanometer coil; it is, therefore, as much an electric phenomenon as the deviation of the galvanometer, or as the battery current itself. We might as well call a common thunder storm *magnetic*, for it produces effects in all respects similar, but still more energetic and rapid.

Coincidence with Spots on the Sun.

A peculiar and interesting circumstance appertaining to *aurora*, is, their periodic coincidence with the appearance of spots on the sun.

The records go to show that the two phenomena have their maxima and minima nearly simultaneously.

Commencing with the year 1763, the maxima of spots and of the *aurora* appear in the following order:

Maxima.

1763 to 1769	6 years.
1763 to 1779	10 "
1763 to 1788	9 "
1763 to 1804	16 "
1763 to 1816	12 "
1763 to 1830	14 "
1763 to 1837	7 "
1763 to 1848	11 "
1763 to 1860	12 "

The length of the periods varies from six to sixteen years.

The sun evidently possesses powerful electro-dynamic properties, as well as magnetic polarity.

Although the forces which act upon the magnetic needle emanate directly from the earth, and are probably induced, in part at least,

by electric currents circulating around it, still the prime source of all such induction, is undoubtedly to be found in the electro-dynamic and magnetic forces of the sun itself.

Now the auroral phenomena, being influenced, as we see them, by terrestrial magnetism, it is not difficult to comprehend how any such great disturbances as must be produced in the sun's emanations by the formation of large spots on its surface, may be the occasion of the coincidence mentioned.

I apprehend that if physicists will hereafter bring their imaginations nearer to the earth in their investigations of aurorial displays, and will candidly consider the facts and hypotheses above detailed, they will be able to see that they are inter-atmospheric phenomena, as simple and as easily accounted for as are *halos*, lightnings, clouds or rainbows.

Adjourned.

December 30, 1869.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The Chairman opened the proceedings by reading the following notes on science.

Gigantic Electrical Instrument.

The largest induction-coil yet made is that constructed by Mr. Apps for the Royal Polytechnic Institution of London. It is ten feet long and two feet in diameter. The soft iron core weighs 123 pounds; the primary wire weighs 145 pounds, and is composed of 11,310 feet of copper wire. The secondary wire is 150 miles in length. Forty bunsen elements supply electricity for the primary coil. The instrument is capable of producing a spark twenty-nine inches long, and the spark will perforate plate-glass five inches thick.

Phosphorescence in the Formation of Ozone.

Dr. Larrazin has found that pure oxygen gas, reduced by a pressure of two millimeters, or even less, becomes luminous under the influence of electricity. This effect is proved to be due to the formation of ozone from a portion of the oxygen. Any compound gas containing oxygen will also become luminous when exposed to a current of electricity in the same manner.

Origin of Cultivated Varieties of Plants.

The Gardener's Chronicle says: "We have always thought that a great deal of the difficulty of referring species, either of fruit trees or any other cultivated plant, to their wild original, was owing to the length of time during which they have been cultivated, which has given opportunity for new conditions to produce an alteration in their characters, or perhaps to confirm some accidental variety which has first led man to appropriate to his use some exceptionally fine or useful plant.

Proposed Railway to Puget Sound.

A party of engineers sent out by the Union Pacific Company under the charge of Col. J. O. Hudnutt of Chicago, to make a preliminary survey of a route for a branch railway from Monument Point, at the north end of Salt Lake, to Portland, Oregon, and finally to Puget Sound, commenced their labors on the 22d day of October last and finished on the 18th of May, on which day they reached the Columbia river, and soon after returned. The party went far enough to demonstrate the feasibility of the entire route. The line run by them first crossed over the Raft River mountains—a comparatively low range about 1,000 feet above Salt lake—then passed along Raft river to Snake river, which was followed on the north side for 150 miles to Burnt river, then up burnt river for a short distance to Powder River valley, from thence across Grand Round valley to the foot of the Blue mountains. This range was crossed by following Grand Round river and Pellican creek upward to the summit, and downward along Meacham creek and Umatilla river, which empties into the Columbia. The most difficult part of the route surveyed, in a distance of 588 miles, was found on the Blue mountains; but the survey fully proved that the average grade for ten miles on each side of the summit would not be more than from eighty to ninety feet per mile. From Umatilla landing, on the Columbia river, to Portland, near the mouth of the Willamette river, a little more than 200 miles, the whole descent is only about 290 feet. The route from Portland to a point on Puget sound, a distance of about 100 miles in a direct line, has not yet been surveyed, but from official reports already made to the government this construction of a railway is regarded as quite feasible.

Are Pigeons Opium Proof?

Dr Wier Mitchell, an American physiologist, has made the singular discovery that very large doses of black-drop may be given to a pigeon internally, and solutions of sulphate of morphia may be inserted under its skin without producing sleep. The last experiment made by him seems decisive. To a large pigeon, which within the two preceding days had swallowed forty-two drops of black-drop, he gave, between two P. M. and six o'clock, twenty-one grains of powdered opium, in soft pills of three grains each. Except the usual tendency to remain quiet, none of the common evidences of opium poisoning appeared, and the pigeon was well and active next day.

A New Thermo-electric Battery.

Messrs. Mure & Claymond lately exhibited at the French Academy of Sciences a battery of sixty elements, composed of very small bars of galena and of thin sheet iron, arranged in the form of a hollow cylinder, so as to apply the heat of a gas burner within it to one end of all the bars, precisely the plan followed by other experimenters. The specimen of the battery exhibited was found to have the electromotive force of one and one-half Bunsen element. M. Bequerel afterward read a long paper on the subject of thermo-electric batteries, in which he expresses the opinion that such batteries, constructed either of metallic alloys or, as in the specimen exhibited, of a metallic sulphide and a metal, are not economical in use. Besides, they are extremely liable to detrimental changes brought on by heat.

Artificial Ebony.

A material said to be far less expensive than the genuine ebony-wood, and capable of receiving a finer polish, is prepared in the following manner: Sixty parts of charcoal made from sea-weeds, are treated with dilute sulphuric acid, and, after being dried, are pulverized and mixed with ten parts of liquid glue, five of gutta-percha, and two and one-half of India rubber, the last two having been previously mixed with coal-tar oil to render them gelatinous; next add ten parts of coal-tar, five of pulverized sulphur, two of pulverized alum, and five of powdered charcoal. The mixture is heated to 300° Fahrenheit, and after having been cooled is ready for use.

TRANSPORTATION OF THE SUGAR PRODUCT.

Messrs. Rousseau and Bonnaterre's plan of converting the saccharine juice of cane or of beet-root into a peculiar saccharate of lime and of transporting salt instead of raw sugar from distant ports to the place where it is to be refined, is soon to be tried on a large scale in some of the French colonies. This compound is very hard, can be kept any length of time, and can be transported with less risk of damage than raw sugar.

ORE SEPARATOR.

Mr. S. R. Krom exhibited his ore separator or concentrator. Air is intermittently forced through the pulverized ore and causes the lighter particles to rise to the surface, when they overflow into a suitable receptacle, and the heavier particles pass out below in a different direction. The ore is first crushed in jaws, which crack it; but rollers are afterward used for finer pulverizing. The machine runs about seventy revolutions per minute. It will concentrate about five or six tons a day. The cost of a large machine is $600.

Mr. Randall remarked that when the sulphates of zinc are acted on by the air bellows, the lighter particles will pass off, and hence the richer parts will be lost.

Mr. Krom said that the intermittent action of the air obviates much of this difficulty.

Dr. A. W. Hall stated that the silver ores of Nevada and Colorado have to be finely crushed, almost to an impalpable power, in a dry state for chemical treatment, before water touches the material. This requires a separator, different from the one here exhibited, as this can only assort ores coarsely pulverized. To separate the flour ore, as fast as produced by the stamps, has been a difficult problem, and attended with great expense. A patent was recently issued to him for crushing ore by stamps or wheels, in an air tight battery, and carrying off the floured ore, as fast as reduced, by an air blast, to a large inclosed funnel-shaped receiver, where it settles, the heavier particles nearest the bottom, etc. The air escapes through a gauge screen at the top. This, however, was not so much intended to assort the heavier particles as to relieve the crushing of the flour as fast as produced; by which their efficiency was greatly increased.

Prof. J. A. Whitney said that some three years since, Mr. Lawrence Holmes, Jr., now deceased, having his attention called to the separation of the granular iron ore from the so called litanic sand of

Canada, had found that when the sand was poured in a thin stream upon the apex of a cone, and suffered to flow down its surface, the lighter particles of sand would drop from the lower edge in a nearly vertical direction, while the ore grains, having a much greater specific gravity, and requiring a much quicker velocity in passing downward upon the surface of the cone, would pass from the latter in lines more directly in line with the surface thereof; the two materials being thus made to diverge in leaving the cone, and consequently being separated. In order to carry out the idea broached by Mr. Holmes, and with his cognizance and approval, he (Mr. W.), had devised a system of ore separating mechanism. It involved a vibrating chute of sheet metal, heated by a furnace to dry the sand passing over it. A conical guide to conduct the stream of sand from the chute to the apex of the uppermost cone, and a series of cones and funnels or guides placed one over the other, in such a way that the ore extracted from the sand in passing over an upper cone would be conducted to a lower one, where remaining sand would be separated, and so on over a succession of the cones until the whole of the sand had been eliminated. As an illustration of the manner in which the same thing is frequently invented by different persons, wholly independent of each other, he mentioned that within the past few months a patent has been granted in England upon a machine apparently identical in principle with that just described.

Mr. T. D. Stetson remarked that he was familiar with the history and *modus operandi* of this machine, and thought Mr. Krom was entitled to credit for the patience and persistence with which he had brought the principle into practical working form. The separation of particles of different specific gravity by an air current, as for instance, in winnowing grain, is different from the same process carried on by means of water, as in ordinary ore separations, in which the material moves slowly through a long vat. In this case the coarser particles settle first, and the separation is more by size than weight. These are, indeed, the two conditions which determine the assortment; one is specific gravity, and the other is size. If the grains are all of a size and form, as a very slight difference in the gravity may assort by ordinary winnowing; but if, as is always the fact in practice with crushed and broken grains, there are an indefinite variety of sizes, then the finer of the heavy particles will go over and lodge with the light, and the coarse of the light material will fall with the heavy. Mr. Krom's machine embodies a very

important modification of the winnowing system, or some very great advances toward perfection therein. The jets of air thrown up through the bed of material in rapid succession have the effect to shake the light to the top and the heavy to the bottom, almost irrespective of the varying sizes of the grains.

Decorative Wall Painting.

Dr. Isador Walz presented specimens of the oleo-chromo decorative wall painting, the invention of Messrs. Cousin, Owry, and Washauer, of France. This method of decorating walls, &c., is intended to supersede the usual mode of frescoing and wall papering. The colors are printed on the paper, resembling somewhat the paper used by lithographers in transferring; the paper is then evenly pressed against the wall, and left there for a few hours, when it is moistened with water; it is then peeled off the wall when the beautiful oil colors are left behind. The paper thus taken off can be used again after recoloring. The size used for preparing the paper is made of camphor, lime, Cayenne pepper, and water. This method of coloring walls, &c., can be made as cheap as the common mode of papering. Mr. Washauer exhibited the manner of putting the colors on articles by covering boards, sheets of tin, &c.

Steam Engines.

Mr. C. E. Emery read the report of the judges for the late fair of the Institute upon steam engines, which occupied the remainder of the evening.

In this connection it may be of interest to state that this was not the first practical test made by the American Institute of steam engines on exhibition at its annual fairs. One previous test, which elicited many points of interest to the engineering profession, was made in the Crystal Palace in 1858, on two engines which had remained in the building from the American Institute exhibition of 1857. An official report was made to the Institute, which never appeared in its Transactions, it having been, probably, destroyed during the burning of the Crystal Palace in 1858. The premiums were never awarded on that test, but a minute and interesting description of the experiments, with their incompleteness and the reasons therefor, was published in the November and December numbers of the Practical Mechanics' Journal of London, for 1858, and has never, so far as known, been before printed in this country. It is from the pen of

Thomas D. Stetson, Esq., the engineer in charge of these tests, then, and ever since, an active member of the Institute and its Polytechnic branch. We reproduce below that portion of two of his letters relating to the test, with the original running heading, combining both letters into one and omitting most of the prefatory matter:

Importance of and Difficulties Attending Practical Tests at Fairs—The Tests of Stationary Non-condensing Steam Engines at the Crystal Palace—The Programme —Methods Finally Adopted—Use and Abuse of the Expansive Principle in Steam Engines—Its Operation in these Engines—Effects of Friction on the Benefits of Expansive Working—Per Centage of the Heat actually Converted into Mechanical Effect—Fluctuations in Speed under Uniform Loads—Ditto under very Variable Loads—Table of Results relating to Economy—Table of Results relating to Regulation—Method of Recording Circumstances—Method of Changing Load.

When a movement was made by one of the exhibitors to procure a practical test of fireproof safes, each exhibitor declared himself anxious for such a trial, but each must, it appeared, be allowed to prescribe the conditions. One would allow each to manufacture a safe of a certain size, thickness, &c., for the especial purpose; another must allow each to make his safe in such style and dimensions as he saw fit; a third would have a committee appointed to select one safe made by each from those already sold and in use; a fourth would allow the manufacturers to designate a certain number, say five or ten such, from which the committee would choose; a fifth, distrusting the ability or the honor of the committee, would allow each party to choose for themselves among the safes already sold by them and in use; while a sixth would *test* no other than the safes entered for exhibition. The evident impropriety of sacrificing the elegantly-wrought structures prepared merely for exhibition, afforded most of the exhibitors a quite reasonable excuse for declining to enter the competition on the basis last named.

There are almost invariably good objections to every programme that can be made for such a purpose; but if, as the published reports and addresses assure us, all the exhibitions are yearly becoming more interesting and beneficial, the making of practical tests, rather than superficial surveys of competing articles, should be distinctly recognised; and there is no journal more proper than yours in which to enunciate the proposition, as the next step to be taken in any really "great" industrial exposition. Let the tests be public, and as thorough as practicable. If the world is not prepared—if, in other words, it is not yet practicable to make any such tests, let it be understood simply that this is the direction in which true progress will be

found. This understood, with all the able committees and presidents to study the problem of overcoming the difficulties, it can hardly be supposed long to escape a solution. It must be acknowledged that there are, it would now seem, a great majority of articles which cannot by any means yet imagined be tested. It would be difficult, for example, to test the efficiency of a novel style of lightning-rod, the permanency of an ink, or the durability of a piece of timber saturated with some novel chemical; and such articles must continue to be judged by their composition and appearance alone. How large a number of articles *may* be made to stand practical tests during, or in connection with, our ordinary annual fairs, can only be ascertained by experiment.

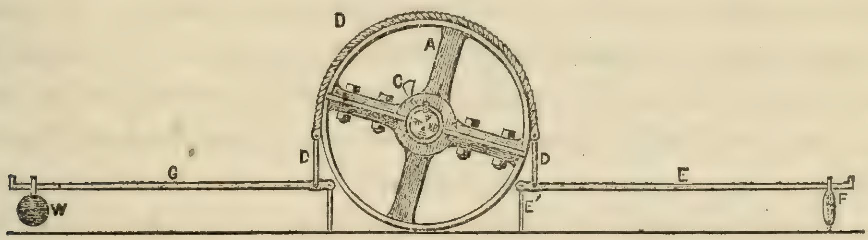
A tolerably full summary of the results of the test of stationary steam engines, at the twenty-ninth Annual Fair of the American Institute, may serve to illustrate both the good effects of such tests and the difficulties attending their introduction.

The fairs of the succeeding autumn are usually advertised in May or June, with a programme of the premiums to be awarded. Among those on which some stress was laid last year, was the offer of a gold medal to be best, and a bronze medal to the second best steam engine; the engines to be tested practically in the presence of a committee of five disinterested gentlemen, to be selected from as many different States, in order to avoid, as far as possible, any local preferences or prejudices. This was, as will appear, too magnificent a programme to be carried out in the present state of exhibitioneering. A definite size and proportion was prescribed, each cylinder to be twelve inches in diameter, with three feet stroke of piston, in order to avoid all possibility of dispute in regard to the advantage or disadvantage due to a difference in these respects; but this was afterward so far waived, that the only two engines finally tested differed considerably in these important points. The points on which the awards were to be determined were advertised to be as follows: 1st. Economy, or the development of much power with a small consumption of steam. 2d. Regulation, or the uniformity of the motion under different conditions; and 3d. Cheapness, or the moderate expense of the machines for first cost and repairs. These points were kept prominently in view during all the postponements and alterations in the programme; and the results given below, though not nearly as full as could be desired, are of considerable interest in showing, or *tending* to show, the economy and regulation of the non-condensing steam engine of the present day.

A number of engines were entered for exhibition, some four of which were said to be intended as competitors in the practical test. Two were connected to the boilers, and used in the ordinary manner to generate power, during the exhibition. It was intended to test the engines at, or immediately after, the close of the fair, and the various members of the committee, men of great judgment and integrity, were agreed on, and invited to be present at an appointed day and hour. This was several times repeated, and on each occasion, either but a portion of the committee were present, or a disagreement with regard to how the tests should be made, rendered the whole proceeding ineffectual. The exhibitors, and nearly all the members of the committee, resided at points from fifty to 400 miles distant, and the repeated postponements was exceedingly inconvenient to all parties. It was not till April, of the present year, that the steps were taken which led to the final trial. At this period Mr. William Sewell, late chief engineer in the navy, was invited, in conjunction with the writer, to examine into the affair, and report to the Institute what had better be done. The report urged the necessity of a radically different method; that of allowing one alone to arrange for and conduct the tests according to his judgment, publicly, and in the presence, if practicable, of a portion or the whole of the committee, but without interference therefrom, and that all the results should then be submitted to the committee for a decision. The report detailed a tolerably full programme, with estimates of the expense, &c., which was finally adopted by the Institute, and the writer was employed to proceed on the plan therein proposed. After notifying a new committee, the fifth, I think, since the commencement, and spending nearly a week in preparation, the tests were made on the 4th and 5th of June last, spending one day on each engine. The committee preferring to receive a report in which the results should be reduced and compared, as well as also all the notes in their original form, the want of leisure delayed the completion of the report until the 1st of the present month, and the committee have not at this date (September 25th), made public their award.

The engraving shows the brake apparatus; the various parts were constructed at different times, and under the superintendence of different parties. It was intended to be equivalent, in its finally perfected form, to a De Prony friction brake, and was made capable of being fitted upon different sized shafts, by simply using for each suitable cheeks, to fill the space between the boss of the brake wheel and

the shaft. A A represent the brake wheel, made in two parts, and bolted together as represented. B B represent the two cheeks referred to. C represents a pin, inserted through both the boss of A, and also through B, into a shallow hole bored for the purpose. In each of the shafts, D, D, D, is an iron strap, to the inside of which is secured a lagging of hard wood, which, fitting tightly to the wheel, forms the brake. The lever, E, having a fulcrum at E', is held in a horizontal, or nearly horizontal position, by the spring balance, F. The corresponding lever, G, attached in a similar manner to the other end of the strap, D, was variably weighted, according to the amount of resistance required. The rubbing surfaces were frequenty "lubricated" with water, by leading a small stream through a hose to the highest point in the wheel.



The strap, D, is therefore pulled vertically downward at each extremity, and by subtracting from the effect of G the effect of E (which latter, at any moment, was to have been ascertained by reading the scale, F), the true resistance in pounds offered to the rotation at the surface of A, was intended to have been easily ascertained. As the experiments finally resulted, this portion was an entire failure; and the fact goes to argue with some force *against the practicability* of making scientific experiments under such circumstances. A preliminary test of all portions of the apparatus was made in advance, on each of the engines; but in repeating the experiments formally, on the days of trial, the scale, F, which had been thus tested, was exchanged for another; and on account of this apparently trifling circumstance, all expectation of deducing the power from the friction brake was, as it ultimately proved, completely frustrated. The new scale employed, which was supposed to be better than its predecessor, because more readable at a distance, employed an index, which, as it subsequently appeared, became deranged, and shifted its place on its axis at each of the many slight blows and collisions to which it was subjected. That portion of the notes taken during the trials, which were intended to show the pull due to the lever, E, were at different

periods, therefore, erroneous in almost every possible manner. The error was discovered before testing the second engine; but the competitors objected, and, as it appeared, with reason, to testing one engine with any different apparatus from the other. The brake, therefore, served to restrain the engine with any desired degree of force, by weighting the lever, G, to the desired extent; and this was the only function performed by this portion of the apparatus.

The perfection of the regulation was, in addition to the usual method of timing by watch, tested by a slight apparatus, improvised for the occasion, with very fair success. Timing in the ordinary manner, by counting the revolutions in a minute, or quarter of a minute, suffices very correctly to ascertain the average rate of a machine during those periods. But no method in general use suffices to show the fluctuations in speed at different periods therein. To ascertain this latter point as exactly as possible, the paper-feeding apparatus of a common recording telegraph instrument was employed to move a slip of paper steadily forward, while a pencil, secured on the shaft of the engine, made, at each revolution, a transverse mark across it. By comparing the length of these graduations, an estimate was formed of the uniformity of the speed. If the motion of the paper could have been absolutely uniform, and the pencil secured so that no elasticity in its fastening, or end play of the shaft, could affect its indications, the record thus obtained would evidently have been mathematically perfect. In practice, the errors were probably very slight, and the results obtained may be considered quite reliable.

The only basis on which to estimate the power of either engine, was the cards or diagrams obtained by the indicator. Believing it impracticable to ascertain the quantity of steam consumed in short periods of a few minutes, or hours, either by measuring the water evaporated in the boiler, or the fuel consumed, the only data from which the quantity of steam, and consequently of fuel, used by either engine, under any given circumstances, were also obtained from the indicator diagrams. The uses of the indicator, and also its faults, as it is commonly employed, are probably familiar to a large portion of your readers. The power was deduced by measuring the area of the card or diagram, and the quantity of steam used was obtained from the terminal pressure, or the pressure of steam in the cylinder at the end of the stroke. I should have remarked, at an earlier period, that both engines were regulated by changing the point of cut-off, or, in other words, by varying the degree of expansion to which the steam

was worked; and that as both engines were intended to work the steam very expansively, under all conditions, with a view to obtain its greatest possible effect, the pressure at the end of the stroke was always quite low. It is hardly necessary to remark here, that the actual quantity of steam used, or rather the whole quantity of water disappearing from the boiler, never corresponds with the amount of pressure existing in the cylinder at the end of the stroke, but always exceeds it; in other words, although in theory the quantity of steam in the cylinder at the end of the stroke can be very accurately ascertained, by comparing the terminal pressure with any good table of pressures and densities, the amount thus ascertained i always much less than the quantity of water disappearing from the boiler. An important field, for the investigation of *savans*, is connected with this subject. It should be much better understood than it now is, what proportion of the water disappearing from a boiler, disappears in the form of vapor, and what of simply minutely divided water. It is probable that the discrepancy in the amounts indicated by the measurements at the two points, *i. e.*, by measuring the quantity forced into the boiler, and by measuring the quantity of steam, thrown out as *steam*, from the engine, is due to three causes: First, to the escape of unevaporated water, mingled with the steam from the boiler; second, to the condensation of vapor, by the radiation of heat from the pipes and cylinders; and third (a point never yet alluded to, so far as I am aware, in this connection), to the *annihilation* of heat, or its change into mechanical effect in the cylinder. It has been proved, by the investigations of Holtzman, Manhiem, your Mr. Joule, of Manchester, and M. V. Regnault (the latter acting under the French government), that in the performance of any work, or, in other words, in the production of mechanical power by any form of heat-using engine, a quantity of heat proportionate to the power disappears; being either annihilated, or actually changed into mechanical work. In a former number you have published a paragraph of much interest, giving some of the latest results ascertained in relation to this subject. The quantity of heat corresponding to a given quantity of mechanical power has not yet been ascertained with absolute precision; but that there is such a relation, and that a quantity of heat does thus disappear, is beyond question. If steam is generated in a boiler, and blown off through a safety valve, all the heat disappearing through the boiler will be found either in a sensible or latent state, in the vapor ascending through the escape pipe; but if the same

steam is used in a well-constructed steam engine, so as to utilize any considerable portion of its power, less heat will be found in the escaping steam, however carefully the radiation from the pipes and cylinders may be guarded against. It is reported to have been found, in some experiments instituted by the French government, that only from one-half to three-quarters of the water disappearing from an ordinary boiler, existed in the form of vapor at the termination of the stroke of an engine working very expansively. Whatever may have been the loss of heat from these causes, it is evident that the system adopted in the tests under consideration measured only the steam existing at the end of the stroke, and are thus liable to considerable error in attempting to estimate the water disappearing from the boilers.

For the sake of comparison of the engines with each other, in the plainest form, however, and also to approximate to the true condition of affairs, I have assumed a well-arranged stationary boiler to be capable of evaporating just eight pounds of water for each pound of fuel, or rather of evaporating so much more than eight pounds, that one pound of fuel would be required for each eight pounds of *steam* actually discharged from the engine. Whether any boiler is capable of performing so well as this, or whether, on the other hand, a majority of good stationary boilers do not actually do better, is a question which each reader must decide for himself. As usually tested, *i. e.*, by the disappearance of water poured into the boiler, boilers are reported capable of evaporating every quantity, from four to twelve pounds of water for each pound of fuel, and that the absolute theoretical effect of a pound of pure carbon would be to perfectly evaporate some two and a half pounds more than this greatest quantity; the water being in each case assumed to be pumped into the boiler at a temperature of 212° Fahrenheit. The evaporation (from a temperature of 100° Fahrenheit) in the boilers of some half a score American naval and marine steamers, a few years ago, averaged 7,235 pounds per pound of anthracite coal.

Owing to the great importance attached to the indicator diagrams in the tests here adopted, it may be well to explain that large indicators were attached, one at each end of the respective cylinders. The area of each piston was one inch, and the scale of motion twenty pounds per inch. To adapt these large instruments, which were designed for slow-working engines, to record perfectly the effect of the steam in those of quicker action, the cocks were bored out of a

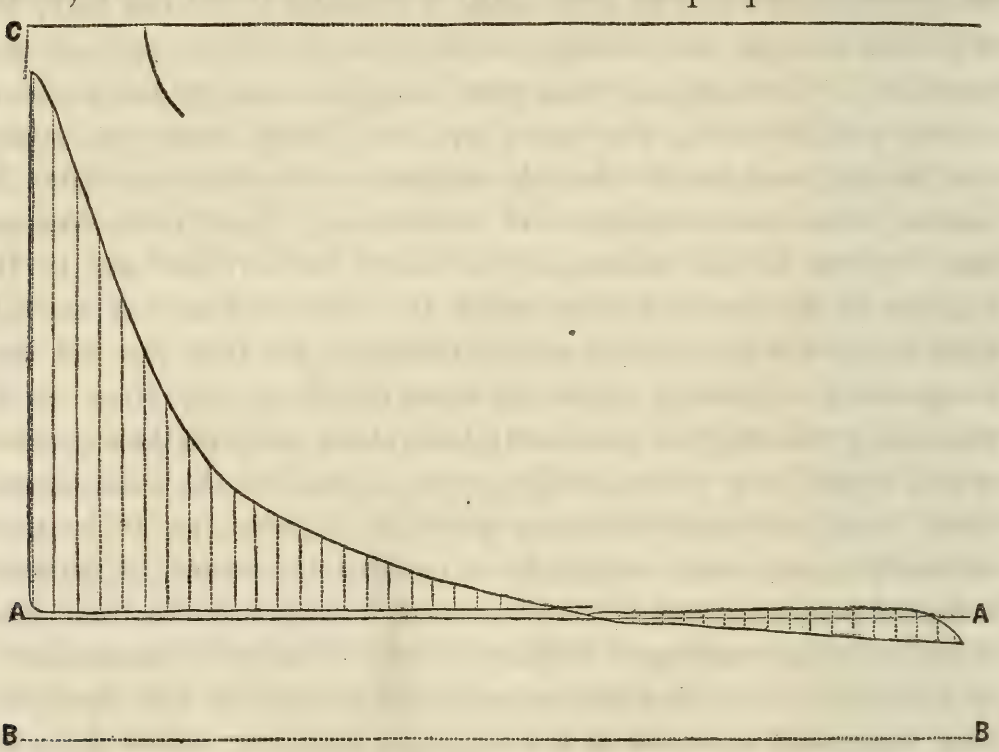
larger size than usual, to allow as free and rapid ingress and egress for the steam as possible; and to avoid the evils due to the elasticity of ordinary cords, the motion of the engine was communicated to the cylinders of the indicators by slender wires running over turned pulleys, and all the fixtures were made as non-elastic as possible. The atmospheric line was, in each instance, produced with as scrupulous accuracy as possible. Owing to the oscillations or vibrations of the pencil under such quick action, it became necessary to measure the area with unusual care, and each diagram was divided into very narrow spaces, to obtain the average height with great accuracy. To compute the quantities of steam used, with any approximation to mathematical exactness, the capacity of the clearance, the ports, &c., should, of course, be added to that of the cylinder proper; and the capacity of these spaces I ascertained with tolerable care, by filling the end of each cylinder with water, while the crank was near its center. It should be observed, that in every instance proper allowance was made for the steam already in this space, before the opening of the steam valve, as, although neither of the engines "cushioned" the exhaust steam to any considerable degree, allowance for the weak steam in this space produces a sensible effect on the results. To ascertain the boiler pressure, and also the pressure in the pipe near the engine, new and accurate steam gauges were attached at both points, and the pressure generally, while working, was only about one pound less in the steam chest of the engine than in the boiler. The tables given herewith show, in a tabulated form, the results deducted from twelve diagrams taken on one, and of thirteen taken from the other engine.

One point of very considerable general interest and importance appears very prominently in the tables of results from both engines, and that is, that while both engines vary their point of cut-off from almost the very commencement to half stroke, the degree of economy compared with the quantity of steam used, increases as the ratio of expansion of both engines is decreased; in other words, the economy appears greater when the steam is cut off at half-stroke, and only expanded to twice its original volume, than when cut off at any earlier period and expanded to a larger extent. This would evidently not be the case with engines which receive the steam more freely, so that the pressure previous to the closing of the steam valve would be very nearly up to that in the steam chest; but a series of experiments which shall determine the exact value of the expansive principle in

both condensing and non-condensing engines of all the usual styles is very much wanted. The table gives the performance, in these respects, of two of what were supposed, by their respective exhibitors, the best and most economical engines in this country; and the results, as far as they reach, go to raise the reputation of the few ancient dotards who continue to hold the opinion that the expansive principle is of no practical value whatever in steam engineering. In a discussion in the Mechanics' Club last winter, a long and well-written essay was read, from the pen of one of our oldest and most practical engineers, arguing against the expansive use of steam by any possible arrangement. The author of that paper contended that the supposed gain by expansion was all fallacious, and that all engines would perform with maximum economy if they were constructed with liberal openings, quick acting valves, little clearance, &c., and receive steam at full pressure throughout the entire stroke of the piston. The argument was received with the coldest kind of courtesy by the majority of the members; but the fact was developed that several present cherished the same views, and, in short, that a considerable minority of purely practical mechanics and engineers considered the ordinarily received law of hyperbolic logarithms a very ridiculous humbug. It is hardly necessary to say, that the truth lies somewhere in the broad space between these parties. There is a gain by the use of steam expansively under almost any circumstances, unless the principle is carried too far; but the gain due to this is never, under even the most favorable circumstances, quite equal to the rule on which it is generally calculated. Multiplying the direct effect of the steam at full pressure by the hyperbolic logarithm of the ratio of expansion, plus one, gives a larger estimate of the effect of expansive steam than is realized by any engine, either in Cornwall or outside of that almost fabulously economical locality. Besides assuming the temperature of the steam to be maintained at the initial point, which is notoriously impracticable even if the weakened fluid be allowed to absorb heat through the sides of the cylinder from a jacket of steam at full pressure outside, the expansive use of steam is always too much interfered with by the slow shutting of the steam valve, by other defects in mechanism, and by the necessary increase of friction of the engine, to allow the perfect realization of all the gain which theory, or rather which *false theory*, assigns to it. If Lord Bacon's *experimentum crusis*, could be fairly applied to the expansive use of steam under some six or

eight varieties of conditions very commonly met with, and if the results could be carefully tabulated or otherwise "salted down" for the information of the engineering world, it would do much to extinguish one of what the same immortal author designated, by a less Latin but almost equally mysterious term, the "idol of the tribe." In plain language mankind are prone to find a greater degree of order, regularity simplicity, and certainty, than is actually indicated when the facts are closely observed. It is an "idol" of the whole human race to "go off at half-cock," and to base on a single experiment, or on no experiment at all, a hideous pile of falsehood, in lieu of the beautiful truth which would be developed by a proper combination and application of patience and industry. The absence of gain by expansion in the engines in question was partly due to its being, under the circumstances, carried in every instance too far. Neither engine was capable of following the piston beyond half stroke. When the load was light, they each "cut off" the steam at a very small fraction of the stroke, and as the load was augmented, automatically increased this fraction until it reached about one half; but if loaded beyond their ability, neither could follow further, but must stop. Both engines were thus brought to rest by the brake at several periods during the tests; but it is hardly necessary to say, that no diagrams, taken when the engine was unable to continue its motion, were made the subject of calculation. The "ratio of expansion" given in one column of the above table relates not to the fraction of the stroke during which the steam valve was actually open in these engines in the several instances, for that was not easy to ascertain definitely, either by observation at the time or by examining the diagram produced; but relates solely to the expansion which would, *in a theoretically perfect engine*, of the same dimensions, have consumed the same quantity of steam, or, to be more critically exact, which would have reduced the steam to the same terminal pressure. As will be observed, it ranges in the table from 3.66 (implying a cutting off of the steam at a little later than one-fourth of the stroke from the commencement) to as high as 8.45 implying, that the cut-off operated at a little more than four inches from the commencement. In point of fact, both engines closed their ports earlier with the lightest, and held them open considerably later with the heavy loads than these figures indicate; but the clearance or equivalent space at the end of the cylinder in the one class, and the insufficiency of the supply of steam, while the valve was held open,

in the other class of instances, accounts for the discrepancy. In most of the diagrams, the piston of the indicator vibrated very violently, being projected upward by the sudden influx of steam to a point on the scale above even the boiler pressure, thence returning partially and vibrating above and below its true position during the entire stroke, which it must be recollected occupied but half a second. No effort was made to check these vibrations, as all the ordinary expedients for the purpose involve a loss of accuracy in the results, either by increasing the friction of the indicator or by preventing the full effect of the steam thereon. In some instances, however, the time of the several changes in pressure would conspire to increase the vibration to an extravagant degree, and in others the same influence would nearly or quite destroy it. This latter effect is very finely apparent in the production of the diagram shown above, which is a reduced *fac simile* of the third diagram in the above table, one in which the steam pressure was nearly up to the highest point allowed, and the load extremely light,—that of the lever alone, which exerted a force on the break strap equal to about 400



pounds. In this figure, A A is the atmospheric line drawn by the indicator, B B the imaginary line for absolute vacuum, C C a similar line showing the boiler pressure, and D the point thereon where the steam should have commenced to expand, in order to sink to the same pressure at the termination of the stroke, according to the

law of Boyle and Marriotte, or the hyperbolic formula. It should be recollected that all these calculations are on the indicator power, taken without any allowances for friction. The pressure being less than that of the atmosphere, during nearly half the stroke, it requires no explanation to see that all the friction of the piston, the piston rod, &c., during that useless or rather negative portion of the stroke, was a dead loss, and a deduction of a similar kind should be made for friction at every point. The negative effect of the pressure alone, during the last portion of the stroke in very expansive working, is in every instance deducted from the positive effect of the other portions before entering the power in the table. If due allowance is made in each computation for what some investigators have termed the "unloaded friction" of the engine, which is of course equal at all points in the stroke, and being due to the tightness of the packing, the weight of the parts, the diameter of the journals, &c., is equal to that which would obtain if the steam followed at its full pressure through the whole, instead of a portion of the stroke; if due allowance is made for this element of resistance, and for this peculiarity thereof, its constancy, it will be seen that the loss in these engines, due to a too high degree of expansion, is in practice very considerable, except when loaded up to very nearly their maximum power.

TABLE A.—ECONOMY.

Name of maker.	Noted during the observations.				Obtained from the diagrams.				Calculated on evaporation of 8 lbs. of water per 1 lb. of coal.			Comparison with absolute Theoretical Perfection.						
	Load.	Steam pressure in pipe.	Revolutions per minute.	End of cylinder.	Mean differential pressure in cylinder.	Indicator horse-power without reductions.	Terminal pressures. Steam.	Terminal pressures. Exhaust.	Pounds water per hour used.	Pounds coal per hour burned.	Pounds coal per horse-power per hour.	Horse-power theoretically due to same quantity of steam used non-expansively.	Per cent of latter realized.	Ratio of expansion.	Horse-power due to same steam, expanded to same terminal pressure.	Per cent of latter realized.	Horse-power due to the whole mechanical equivalent of the heat in the steam.	Per cent of latter realized.
Messrs. Hinckley & Egery's Engine.	400	78	58	Front.	7.5	8.93	16.	16.	675	84	9.48	18.56	48	5.81	32.48	27½	262	3½
	400	80	58	Front.	13.62	16.21	16.5	16.	690	85	5.25	20.22	80	5.45	35.96	45	268	6
	400	75	69	Front.	7.86	13.62	12.5	15.	628	78	5.76	17.24	79	7.2	29.67	45	244	5½
	1,780	67	54	Front.	22.57	25.00	20.	16.	759	94	3.79	21.6	111	4.1	35.56	70	295	8½
	1,780	67	54	Back.	15.14	16.85	17.5	16.	667	83	4.95	18.52	91	4.78	30.24	55	259	6½
	2,405	71	56	Front.	22.25	24.58	21.5	17.	851	106	4.33	20.42	120	4.	39.97	61	331	7¼
	2,405	71	56	Back.	18.09	20.81	18.5	15.	737	92	4.43	17.68	118	4.62	39.76	52	287	7¼
	2,957	73	54	Front.	26.71	28.44	20.	15.	760	95	3.34	18.40	154	4.4	37.15	66	296	9½
	2,957	73	54	Back.	28.53	31.00	24.	17.	914	114	3.68	22.12	140	3.66	43.25	71	356	8¾
	2,957	74	54	Front.	28.13	28.89	23.	17.	803	100	3.47	21.25	136	3.86	40.82	70	312	8
	2,957	74	54	Front.	30.00	33.9	21.	15.5	792	99	2.92	22.72	149	4.23	43.79	77	308	11
	2,957	74	54	Front.	27.33	30.88	22.	17.5	836	104	3.38	20.32	152	4.04	39.42	78	326	9½
	Mean.	73 1-12	......	......	.....	23.25	....	....	......	......	4.56	....	114.83	......	....	60.54	....	7.6
Newark Machine Company's Engine.	400	70	54	Back.	6.1	8.78	10.5	15.5	532	66	7.57	14.21	62	8.09	25.38	34	206	4¼
	400	78	54	Front.	6.36	9.16	13.5	15.	703	88	9.59	19.7	46	6.88	35.1	26	273	3¼
	400	78	54	Back.	2.08	3.	11.	15.	562	70	23.41	16.04	19	8.45	28.62	10½	218	1¼
	1,780	74	54	Back.	11.00	15.84	16.	15.	816	102	6.44	23.34	69	5.62	38.88	41	317	5
	1,780	74	54	Front.	11.6	16.54	14.	16.	709	88	5.36	20.43	81	6.35	36.72	45	276	6
	1,780	74	54	Front.	12.47	17.95	14.	15.	708	88	4.93	20.43	88	6.35	36.72	48	275	6½
	2,957	69	54½	Back.	17.01	24.5	16.	15.5	823	103	4.2	20.41	120	4.93	43.04	57	320	7½
	2,957	69	54½	Front.	12.9	32.97	19.	16.	941	118	3.56	27.96	118	4.42	47.96	69	366	9
	2,957	74	53½	Back.	16.78	23.94	15.5	15.	790	98	4.12	22.39	106	5.74	39.59	60½	307	7¾
	2,957	74	53½	Front.	20.47	29.2	16.	15.5	775	97	3.32	19.59	148	5.56	40.12	73	301	9¾
	2,957	73	52	Back.	20.33	29.27	17.5	15.5	874	109	3.73	20.23	145	5.02	43.89	68	341	8½
	4,275	73	52	Front.	22.68	30.24	18.5	16.	928	116	3.83	21.38	141	4.75	45.24	67	361	8½
	4,275	81	50	Front.	25.7	34.64	20.	15.	926	115	3.34	22.58	153	4.8	48.85	79	360	9½
	Mean.	73 12-13	......	......	......	21.23	....	....	......	......	6.43	....	99.69	......	....	52.15	....	7.42

There are many points of more or less interest presented in the first table, but want of space allows particular attention to be invited to but one more; the per centage of the mechanical equivalent actually realized. The last column in the table brings out, in a very strong light, the broad margin which yet remains for improvement in the use of heat as a means of generating power. Of all the heat produced by a given quantum of fire, a large amount, from one-quarter to one-half, escapes up the stack in the heated gases. The remainder penetrates the metal, and entering the water, combines therewith, and forms the steam, which rises and flows through the connections into the cylinder, acts on the piston with full pressure through a portion of its travel, is then isolated (or "cut-off," as it is invariably termed in this country) from its connection with the boiler, expands itself as the piston proceeds, until, at the end of the stroke, its tension is but little more than sufficient to overcome the friction of the engine when it is released; and after traveling through a "heater" to warm a supply of feed water, it floats away into the atmosphere, gradually imparting its remaining heat thereto, and being itself absorbed thereby. If the round of operations is properly performed in the the manner here indicated, it is the most economical use normally made of heat in connection with non-condensing engines; but the proportion which is thrown out to serve the ignoble end of warming the external atmosphere, ranged in the engines in question between eighty-nine and ninety-nine per cent, even of the fraction which had been manufactured into steam. The calculations in the last two columns in the table are based on the approximately correct supposition that each pound of steam contains, including both sensible and latent heat, 1,212 degrees Fahrenheit above zero, or about 1,000 units above the ordinary boiling point; and that the absolute mechanical equivalent of a unit of heat, or sufficient to warm one pound of water one degree Fahrenheit, is the elevation of 772 pounds, one foot.

Table B.—Variations in Speed under uniform Loads.

Name of maker.	Load on brake.	Pressure of steam above atmosphere.	Rate. Of slowest revolution during the experiment.	Per cent too slow.	Of quickest revolution during same experiment.	Per cent too quick.
Hinckley & Egery's Engine.	1780	70	52	3¼	64	18½
	1780	68	52	3¼	62	14¾
	1780	73	50½	6½	60½	12
	1780	69	47	13	59½	10½
N. M. Co.'s Engine..	2532	55	49½	8	55	2

Table C.—Variations in Speed under Loads very suddenly Varied.

Name of maker.	Pressure of steam in pounds above atmosphere.	Slow. Loads suddenly applied to brake strap.	No. of revolutions before lowest speed reached.	Rate of engine at slowest.	Per cent too slow.	No. of revolutions before ordinary speed again reached.	Opposite extreme to which speed oscillated before ordinary speed permanently recovered.	Fast. Load suddenly diminished from that in column two to	No. of revolutions before quickest speed reached.	Rate of engine at quickest.	Per cent too quick.	No. of revolutions before ordinary speed again reached.	Opposite extreme to which speed oscillated.
H. & E.'s Engine.	78	3200	3	52½	2½	5	....	0	5	66	22¼	..	....
	78	3200	2	50½	6½	....	....	0	..	..	..	..	...
	21	3200	3	52½	2½	....	....	0	4	69½	28¾	..	....
N.M. Co's Engine.	55	3200	6	44	18½	9	....	0	5	63½	17½	11	....
	55	4600	3	33½	38	11	....	0	4	61½	14	8	....
	58	3200	5	36	33½	15	58	0	3	65	20¼	15	....
	80	3200	4	46	15	5½	61	0	5	64	18½	17	49

The results in regard to perfection of the regulation is a point so purely practical, that but little seems required beyond a faithful exhibit of the actual results obtained. Table B shows the fluctuations in velocity of the engines under uniform loads. The lever, it should be understood, was subjected, during the experiments noted in this table, to no change of load; and supposing the quantity of water applied to the brake to be uniformly the same, and the resistance due to the frictions consequently unchanging, the fluctuation in velocity, amounting to some thirty per cent of the true speed on one engine, may be explained only by supposing, what was really the

fact, that the governor was subject to considerable fluctuations, and consequently changed the point of cut-off incessantly.

The next and last table is of most interest as showing the rapidity of the regulation, or, in other words, the amount to which the speed of the respective engines varied under loads changed very suddenly from extremely light to extremely heavy and *vice versa.* The strips of telegraph paper marked by the means above described, as also all the diagrams produced by the indicator, were severally inscribed with a number or letter, by which they could be easily designated, and a corresponding number or letter being entered in a large sheet of notes kept for the purpose, allows the precise time, pressure, load, and every other important fact relating thereto, to be ascertained with certainty. A mark with colored pencil was also made on the telegraph strips at the moment an order was given to change the load, the color blue or red indicating whether the load was put on or taken off. The method of applying the load was to weight the lever, G, to about as great an amount as one man could conveniently lift, and to allow an active man first to raise the lever and hold it at a considerable elevation, and then at a given signal to suddenly bring it down, adding to it the whole weight of his body, and holding it down until another signal should induce a return to the first position. The engine would of course, when suddenly lightened, move quicker than its proper rate, and when it had taken time to nearly or quite recover, a sudden increase of load would reduce its speed below the proper velocity. The greater load in the largest engine in the fifth experiment was due to the placing of two men instead of one upon the lever. One engine, it will be observed, was more subject to increase than to decrease of motion under these circumstances, while the other was faulty in the reverse direction; the difference being due to peculiarities in the governors and valves, and in the connections of these elements, which was very dissimilar in the two engines.

After an interesting discussion on testing engines the Association adjourned.

January 13, 1870.

Prof. S. D. Tillman, in the chair; C. E. Emery, Esq., Secretary.

The following notes on applied science and new discoveries were presented by the chairman:

Preparation of Oxygen.

According to M. Delaurier, oxygen may be made very economically by subjecting manganate of lime to heat, in which case oxygen gas is given off in great abundance.

Cinnabar in Borneo.

A vein of nearly pure sulphide of mercury has been found in the district of Sarawak, Borneo. A large quantity of the ore has been tested and found to yield from seventy to eighty per cent of quicksilver, showing that this cinnabar ore is richer than any other now known.

Bronzing Copper.

M. Zalewski lately stated before the French Academy of Sciences, that when objects made of copper are immersed in molten sulphur wherein lamp-black is kept suspended, the objects so treated obtain the appearance of bronze, and can be polished without losing that aspect.

Pyrogallic Acid a Poison.

According to M. Personne, of Paris, pyrogallic acid produces the same effects in the system that phosphorus does, in withdrawing oxygen. Animals to which this acid had been given died, exhibiting symptoms like those manifested when poisoned by phosphorus.

New Coincidences of Metallic and Solar Spectra.

The Comtes Rendus announces that Mascart has, by the aid of photography, compared the ultra violet lines of the solar spectrum with those made by the burning of different metals and revealed by the spectroscope. In the case of iron, Mascart found more than 100 new coincidences with solar lines, in addition to the 450 lines previously observed by Angstrom in the visible spectrum.

Nutritive Value of Common Roots.

M. Coremwinder has estimated the quantity of nitrogen contained in the following roots, and found the per cent in yellow beet-roots, 1.087; in sugar beet-root, 1.044; in rutabaga, 1.41; in pulp of sugar beet-root, 1.36. The quantity of nitrogen contained in vegetables of this kind, although not an absolute criterion, will express very nearly their average value as food, taking other constituents in consideration.

Contamination by Zinc Tanks.

M. Ziurek calls attention, in Dingler's Polytechnic Journal, to the fact that water, kept in small reservoirs made of zinc or collected from roofs covered with zinc, is invariably contaminated with that metal, and that the use of such water for domestic purposes is highly injurious to health. The author recommends that where zinc vessels are used for the purpose indicated they should be painted over with asphalt varnish or any iron pigment.

Utilization of Leather Scraps.

The Paris Cosmos states that a material which can be pressed into the form of combs, buttons, knife-handles, etc., may be made from leather scraps by cutting them into small pieces and keeping them for several days in chloride of sulphur; in this way they become hard and brittle. After being washed they are dried, ground to powder, and mixed with glue, or a solution of gum-arabic, or any other adhesive substance, when the mixture is ready for the moulds. Dr. D. D. Parmelee remarked that this substance containing glue or gum-arabic could not be water-proof.

Diatil.

This name is given by J. M. Merrick to a plastic mass which he obtains by mixing equal parts of gum lac and finely divided silica. In order to obtain a perfectly homogeneous composition, the mass is pressed between rollers, heated by steam, like those employed in India-rubber factories. While hot it can be moulded into any form. It is preferable to "artificial wood," because it does not absorb moisture. Medals made of this composition have great sharpness and luster. The silica is prepared by precipitating it from the silicate of potash.

Antidotal Power of Phenol.

Mr. Schiffman writes from Valle-Menier, Nicaragua, to the Moniteur Scientific of Paris, that after a very severe epidemic of Asiatic cholera which caused, during fifteen months, the death of a large number of people, he commenced the use of phenol or carbolic acid, causing all the rooms and passages of the houses occupied by 300 people to be daily sprinkled with water containing a small quantity of this acid, with the result that neither cholera nor fever and ague, which had long pestered that locality, had since made their appearance.

The Reflecting Pyrometer.

The American Journal of Science and Arts, after noticing a statement in Poggendorff's Annalen that Prof. J. Müller had made an application of Poggendorff's mirror arrangement to the measurement of the expansion of solids by heat, says: "It is not a little remarkable that neither Prof. Müller nor the distinguished editor of the Annalen should be aware of the fact that the above-mentioned instrument is not new, either in principle or application. The reflecting pyrometer was invented in 1826 by Mr. Saxton, now of Washington, D. C., and used by him in adjusting the compensation of a pendulum. It is, however, first mentioned in print in Prof. Bache's reports on Weights and Measures for 1846 and 1848, and fully figured in the report for 1856. It is referred to as having been used to compare the measuring bars for the base lines, in the Coast Survey Report for 1847, and again more particularly in that for 1854, in which the base measuring apparatus is described and figured."

New Blasting Powder.

Alfred Nobel, the engineer who first practically applied nitro-glycerin to blasting purposes, has recently taken out a patent in England for a new explosive compound. According to the inventor, a mixture of nitrate of potash, soda, baryta or lead, with resin, sugar, starch, or other bodies rich in carbon, cannot be employed for blasting except under strong pressure; but, if moistened with a small quantity of nitro-glycerin, so that each grain is surrounded by a layer of it, the mass will become explosive under ordinary circumstances. Nobel gives the following proportions for his new blasting material: "Sixty-eight parts of nitrate of baryta, twelve parts of charcoal, if possible, such as contains some hydrogen, and twenty parts of nitro-glycerin; or, seventy parts nitrate baryta, ten of resin and twenty of nitro-glycerin. An addition of five to eight parts of sulphur enhances the effect, but diminishes the safety. It is set on fire by ordinary primers with fulminate of mercury."

The Speed of Birds.

Spallanza found that the swallow can fly at the rate of ninety-two miles an hour, and he computes the rapidity of the swift to be not less than 250 miles an hour. If it can move at this rate, even for a short distance, the swift must be ranked as the swiftest of birds. The

common crow can make about twenty-five miles, the eider duck ninety miles, the eagle 140 miles, the hawk and many other birds 150 miles per hour. The flight of migratory birds does not probably exceed fifty miles within the hour. A falcon belonging to Henry IV, of France, escaped from Fontainebleau and was found at Malta, having made at least 1,530 miles within twenty-four hours. Sir John Ross, on the 6th of October, 1850, dispatched from Assistance Bay two young carrier pigeons, and on October 13th one of them reached its dovecote in Aryshire, Scotland. The direct distance being about 2,000 miles, the speed was comparatively slow. Birds whose flight has excited astonishment have been in most instances assisted by aerial currents moving in the same direction.

A member remarked that the crow was swifter than the hawk, and would always conquer when those two came in contact.

A Curious Apple.

The editor of Tilton's Journal of Horticulture for December, says: "We remember seeing, some years ago, at an exhibition of the Massachusetts Horticultural Society, an apple called the 'No Core,' which, singularly enough, had two cores. We had also another apple, received from Messrs. Baumann, the French nurserymen, the 'Hillars Grande,' which showed the same extraordinary formation, and in turning over the New Duhamel, we came upon a colored plate of the 'Pomme Figue,' showing also a section of the fruit and exhibiting the same peculiarity. We think it possible that the two varieties are identical. The flower of the Hillars Grande was destitute of petals, or showed only what was supposed to be bracts in their place. The section of the flowers of the Pomme Figue given in Duhamel appears as if these supposed bracts were the sepals of the calyx of the second flower; one being superimposed upon the other on the same axis. The fruit of the Hillars Grande was of a yellow color, with dull, reddish-brown cheek, pearmain-shaped, tapering, with quite concave lines, and showing the five carpels very plainly in prominent knobs at the apex. It was sweet, and rather dry, and of little value except as a curiosity."

Filtration of River Waters for St. Louis.

Mr. James P. Kirkwood, C. E., has made a report on the filtration of river waters, for the supply of cities, as practiced in Europe, and recommends to the Water Commissioners of the city of St. Louis,

Mo., the erection of five filtering reservoirs, each 260 by 156 feet, leaving one out of use for the purpose of removing its accumulated sediment. The filter-beds are to be formed as follows, commencing from the puddle bottom: Drain pipe, twelve inches in depth; broken stone, twenty-four inches in depth; gravel of nut size, twelve inches; gravel of pea size, twelve inches; coarse sand, twelve inches; fine sand, eighteen inches. About seventy-five imperial gallons of water per day will be filtered through each square foot of surface, and as the area of each filter is 37,440 square feet, it will yield 3,360,847 U. S. gallons in twenty-four hours. As the city will require about 12,000,000 U. S. gallons daily, the five such filters will be amply sufficient.

In relation to this item, Mr. C. E. Emery said that the water of western rivers is not very inviting for drinking purposes, as it very much resembles that taken from a mud puddle. It is, however, drank without injurious effects. At the mouth of the Mississippi river the fresh water floats on the surface of the salt waters of the gulf, and it is not unusual there to be able to drink the muddy water lifted by a pump from near the surface, while the water admitted at the sea-cocks in the ship's hold is clear salt sea water.

Dr. L. Bradley remarked that this muddy water is found in all parts of the Missouri river. There are certain localities which furnish this peculiar mud. It is not unhealthy; the water is drank right from the river without any filtering. It seemed to him, however, that it would be cheaper to bring down the Mississippi water for this purpose. The Missouri river water always gives persons who are not use to it the diarrhea, though it is not unpleasant to take.

The regular subject for the evening was announced to be

Steam Engines.

Mr. J. B. Root said he would inquire why it is that nine-tenths of the power of an engine is lost. An accurate table of the loss by friction in engines is much required. Nothing reliable on this point has yet been had. Where the friction of an engine is great, the steam has to be increased in proportion, so if we could reduce this friction, say even one per cent, we would have less pressure to raise, and thus gain to that amount. He also thought that important savings would be made by improvements in the boilers where the steam is generated.

Mr. Charles E. Emery was called upon to speak by several mem-

bers present, and stated that he expected that the evening would be occupied by others, and he had, therefore, not prepared either a paper or an address, but, on a subject in which he was so much interested, he would try to make a few remarks. He continued:

Too many persons think of a steam engine as a greasy machine, requiring the attendance of a greasy mechanic, and too few realize that to properly understand its principles, and the best method of its construction, requires a thorough knowledge of some of the most important branches of dynamical science. It does not follow, however, that a good steam engine can be built by a mere theorist, for the very extreme to which theories of limited application have been carried by some parties, has done much to hinder true improvement. So, on the other hand, the mere mechanic makes little or no progress, for as well might we expect a greater delivery of fluid from a crooked, fanciful shaped pipe than from a straight one, as to anticipate any real economy in changing the mere shape of a steam engine, or even in the use of many of the ingeniously constructed valve and varieties of valve gear. To improve the steam engine requires, first, a practical knowledge of its details and their operation, and, second, a scientific knowledge of the laws relating to heat and its applications. The results of practical experiments, properly compared and classified, add to the stock of scientific information, and it has, in this way, been found that the results due to theory are often so modified by conditions and circumstance, as to be of little practical value. A further inquiry to ascertain the reasons for the observed facts has, however, in many cases, suggested remedies which would insure very nearly the results expected.

Few subjects have excited more discussion than that of the expansion of steam, and inquiries are continually being made as to what is the most economical point of cut off. It has been my privilege to have been engaged for the U. S. Government, at the Novelty iron works in this city, for a number of years in experiments to settle these points; and, although the official report has not been published, I may say, without impropriety, that there is no one point where it is most economical to cut off the steam, for the point of greatest economy is varied by every change in condition, but particularly by variations in steam pressure. In fact, it would seem that the steam pressure has more influence upon the economy than the expansion. The most economical point of cut off in a non-condensing engine using 100 pounds of steam is about one-sixth of the stroke, and if a

horse power cost three pounds of coal per hour, under these circumstances, it will cost a little less than five pounds in an engine using 100 pounds of steam, without expansion, while it will cost about six and one-half pounds in an engine using only twenty-five pounds of steam, with the most favorable degree of expansion. (Mr. Emery here illustrated his remarks by diagrams on the blackboard). In condensing engines the differences in economy for the various steam pressures are not so great, but the fact is equally true that economy is due as much to the higher steam pressure as to the expansion. The reason of this arises, in a great measure, to the fact that the back pressure forms a smaller percentage of a high steam pressure than it does of a low one; but another reason is that a high temperature is necessary in order to prevent the steam from liquifying, or becoming greatly condensed during expansion. It is now determined, beyond dispute, that the great enemy to the expansion of steam is the internal condensation in the cylinders. Steam may enter the cylinder at 300° and leave it at 212°, or even less, in a condensing engine. The metal walls of the cylinder during the exhaust stroke are cooled to the temperature last named, and of course, until reheated, form surface condensers for the live steam which flows in upon them, during the return stroke. The live steam has therefore two offices to perform, first that of heating the surrounding walls, and second that of keeping up the pressure, and performing mechanical work. Now, in some cases, it takes as much steam to do the one thing as the other, and as the steam used for heating is condensed, it helps very little to fill the cylinder and the engine was in fact two cylinders full of steam where the volume of one only is required. The condensation is rarely as extreme as this, but it always has more or less influence. This condensation must be separated entirely from that which is due to external refrigeration. The internal refrigeration is not so great in non-condensing engines, but they are subject to the greater loss due to the high back pressure at all steam pressures below 100 pounds. The internal condensation can be lessened in various ways, as, for instance, by steam jacketing, superheating the steam and using compound engines.

In reply to the remarks of the last speaker, I will say that in the best steam engines, the largest proportion of the heat *must* go off with the exhaust steam, in order to keep it in the state of steam; that is, it must contain its latent heat, which is the principal portion. For this reason, the best steam engines now in use, utilize but one-ninth

to one-tenth of the heat in the steam supplied by the boiler. Then, again, the boiler does not seem to transfer to the water all the heat evolved by the combustion of the fuel. In this direction the method of saving is better understood. A boiler with short tubes and quick draft will furnish a given power at a certain cost in fuel. Now, in order to save a small quantity of fuel, the size of the boiler has to be greatly increased; hence there are in practice boilers constructed with great variations in their proportions, but the economy of each can, by simple calculation, be determined with great accuracy by the skilled engineer.

Mr. J. K. Fisher said he thought the boilers more at fault that the engines in regard to economy. In Europe the steam boiler is much more advanced than it is here; we have been crowding into boilers a vast amount of heating surface, yet it appears by the experiments of various engineers, that the loss of heat from various causes amounts to twelve per cent as a minimum, and fifty-four per cent as a maximum, so that about one-fourth of the heat is only utilized.

Adjourned for two weeks.

January 27, 1870.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

Tempering Steel.

Professor J. Phin said that there was hardly a subject in the arts more important than that of tempering steel. The difficulties in tempering steel properly are not met with in small articles, but mostly when large masses of it are to be treated. It is laid down as a rule by writers on the hardening and tempering of steel, that all bright steel requires a coating of some kind before putting it into the water, more particularly when the article to be hardened is of large size. If this is not done it is very liable to crack. This is shown in the case of common turning tools, which if hardened with the external skin left by the action of the hammer in shaping them, will always stand and keep a finer and more certain edge than if ground before hardening; the precaution being taken to heat the steel to the exact temperature required to bring it when cooled to the desired hardness without subsequent tempering. Mr. Reid, of Woolwick, has recently written a very able work on this subject, but he did not touch on the method about to be described. It has long been known that certain

water gave a peculiar temper to some kinds of steel. The sword blades of Toledo, no doubt, owe their peculiar temper to the water employed in hardening them. The manner of dipping different articles must be varied according to their shape. Care should be taken that the water be not intensely cold, for which reason it is best to throw into it a shovelfull of burning coals, or dip into it a hot iron rod, to take the chill off before dipping the steel. If the article varies in thickness, the thick part should be immersed first, and as near the center of the vessel as can be. In the process of tempering after hardening, very little difficulty is found, and it is an easy matter to draw the steel to the required point of hardness. The temperature of boiling water will sensibly soften the temper of steel. The hardening of steel is the point to which he wished to direct attention, that is, hardening without producing any fractures. A piece of steel thick in one place and thin in another, if hardened, will contract, or it will be warped, but it will not do this if it is allowed to cool equally. Therefore, in hardening the steel must be equally exposed, and also cooled in all the parts. In case the skin left by the hammer is not retained on the steel, it may be coated with some suitable substance, like soft soap, black lead, plumbers' size, &c. What are the peculiar qualities of different waters, which will best extract the heat from the steel? Some urge the use of salts and other chemicals that produce an intense cold, but experiments in this direction have not been attended with success. We should approximate the amount of water to the amount of steel. As we usually regard it, water is a non-conductor; mercury is a better one, and will withdraw the heat much quicker than the water, but, withal, it is not of much value in tempering. Water for large masses of steel is found to be the best, and the great problem is to get the water in such a condition as to take away rapidly the heat, and for this purpose the water should be in close contact to the steel. It is a common thing to see small air bubbles in a tumbler of water after standing some time in a room, and if water is boiled in a flask these bubbles will remain; and if this water is re-boiled it will be found to require more heat to do it, and it must be agitated before it will boil again. It has long been known by smiths that there is no water better for tempering than old water. The cause is simply this: That the constant insertion of red hot metal renders the water airless, and makes it better for tempering. The true system for obtaining a suitable water for tempering steel is to get a liquid, the boiling point of which is high. For hardening

in lead, black lead and other substances will answer a good purpose to coat the steel with; but when a common fire is used, prussiate of potash is to be preferred. The prussiate, powdered fine, may be sprinkled or sifted uniformly over the surface of the article. It may be then put into the fire, heated to the proper degree, and then plunged into the water, except when the piece of metal is large, in which case a second coating of the prussiate, and a second heating before cooling may be proper. The various solutions that have been tried do not appear to have any chemical action whatever.

Mr. Norman Wiard said he believed he was the first to advance the theory of hardening steel, and he was proud that he had done so. When a piece of steel is tempered, it is simply in a state of tension, that is one part of it is trying to get away from the other. If one part is contracted in advance of the other, it is contracted with a tensile force similar to drawing out the parts of a truss bridge. If a piece of steel is contracted around the surface, every part will be put in the same tension, each atom tending to pull away from the other. He heated a piece of steel the thickness of a sheet of paper, and placed and cooled it suddenly and equally with two wet sponges; but it was not hardened, and bent easily, and was as soft as brass. If the thick end of a planing knife is first immersed in the water it will become equally hardened without warping; this will also obviate the cracking usually found in tempering the knives for planing machines. The tempering of steel is simply putting it in a state of tension. The chemical combination of waters for tempering steel can have no effect on the process. In hardening steel it should be put straight down into the water without moving it sideways, for the least pressure in any direction will cause the side pressed against to be cooled quicker than the other. The specific heat of mercury is .03332, water being 1. This latter substance is a bad conductor of heat. Mercury absorbs heat quite rapidly, and for this reason is used much in the process of hardening steel. The Damascus sword blades are tempered when the cold north wind blows; when taken from the fire the steel is cooled by exposing it to the cold wind which tempers it slowly and evenly. Liquified carbonic acid gives a temperature of 200 degrees below the freezing point; when used for hardening would make the surface of the steel very hard.

Dr. Vanderweyde remarked that if iron could be hardened on the surface it would make good magnets. An iron foundery in Twelfth street, near Avenue C, makes very good iron, which is well

adapted for magnets. He inquired the reason of this, and was told that the iron was from the Lehigh mines, and was always of the same quality. The old method of case-hardening iron by packing the iron in a box with animal refuse, such as scraps of horns, hoofs, leather and the like is by some preferred. These materials are charred just enough to permit their pulverization. Bone dust may be substituted in place of these. The articles are packed with the material in an iron box, carefully luted with clay, and placed in the furnace, where it is allowed to remain for a length of time proportioned to the thickness of the film of steel to be formed upon the iron. An hour after the box is thoroughly heated through, may give a thickness of one-sixteenth of an inch, and a longer time in proportion. The box when taken from the fire is emptied into pure cold water, and the articles may be dried by shaking them in saw dust. Case-hardening by coating the surface of the iron with a paste of the prussiate of potash, and heating in a clear fire, is more convenient than the former, but the results are not considered so good.

Dr. L. Bradley remarked that it was well known that water cooled steel much quicker than oil, as articles hardened in oil did not require any tempering.

Mr. Chas. E. Emery stated that a patent has recently been taken out in this country for a compound of sulphuric acid, and other substances, which are mixed with the water to make a bath for tempering steel. The articles to be tempered, after being highly heated, are dropped into the solution, which cools them with sufficient rapidity to get the proper temper. By this process steel springs for railroads are reduced in weight fully twenty per cent. This promises to be a most important invention. The springs require a less number of leaves on account of the slight damage done to the steel. The bath cools the metal with just sufficient rapidity to get the proper temper. There are two ways of annealing steel; one is to allow it to cool slowly in the ashes of the fire, and the other is to heat the steel to a cherry-red and allow it to cool until the color can just be distinguished in the dark, then to be plunged in water, and will be found to be very soft and can be cut with the greatest ease.

Mr. Beckers said that the hardening of steel and the case-hardening of iron, although sometimes attained by similar means, are wholly different in character. In using the prussiate of potash but a small thickness of the iron is coated with steel, and if the iron is exposed for a length of time the steel will penetrate so that in time the iron can be transformed to steel by simply continuing the process.

Mr. Joseph A. Miller remarked that the difference in the crystallization of cast iron arising from the sudden or prolonged cooling of the metal, as the case may be, and the molecular changes probably induced in steel by hardening, were widely different. Case-hardening is simply converting the surface into steel. Blistered steel is made by the process of carbonizing. Cast iron contains from two and one-half to three per cent of carbon.

Mirage.

Mr. Charles B. Boyle read a paper on this subject, and by means of an arrangement of mirrors, illustrated his idea of the cause of the phenomenon.

He said Dr. Hall, at a previous meeting, took the ground that the mirage belonged only to catoptrics, *i. e.*, belonged to the subject of reflection. An illustration of the double images of the mirage was then given. A miniature vessel was placed upon the surface of a horizontal mirror, and a white screen representing the sky, then held beyond it, when the gas light was held in a proper position on the opposite side of the mirror, the double shadow of the vessel was seen on the screen, the one erect and the other inverted. It was then contended that the mirage was in all cases a reflection and not a refraction, and that when seen in the air some cloud or vapor was present to serve as a screen upon which it could be made visible. Various instances were cited and explained upon this hypothesis. It was then suggested that in some cases the mirage might be produced by reflection from the lower surface of a stratum of air. The discussion then became general, and various facts and explanations were brought forward upon both the reflection and refraction theory. The phenomenon of "looming up," as it is called along this coast, was mentioned, but hardly received a satisfactory explanation from either side. The discussion, though long and rather exciting, was very good natured and exceedingly interesting.

Adjourned for two weeks.

February 10, 1870.

Prof. S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

The usual interesting summary of scientific news was read by the Chairman, the report of which has been mislaid or lost.

Dry Ore Separator.

Mr. P. M. Randall exhibited a model of Chubbs' Dry Ore Separator and Concentrator. The machine is constructed so as to cause puffs of air to pass through finely reduced ore for the purpose of separating it according to its specific gravity. The bellows is worked by means of a lever underneath. The ore bed is made of cloth, so that the air can pass through it; the bed inclines in two directions, and as the ores become separated the heavier ore, conducted by a guide plate in one way, while the lighter passes in an opposite direction. In separating the mineral from the gangue, or vein-stone, it is necessary to finely reduce and size the ore; for if the ore be not finely reduced, the mineral will adhere to the gangue, and the ore be imperfectly separated; and if not sized, the larger grains of gangue will mingle with the mineral. This machine has been used successfully in treating the ores of galena graphite, (principally Ceylon ores) iron and gold bearing rock, containing sulphuret of iron, cobalt and nickle. The size of the working machine is six feet long and twenty inches wide, and it is capable of separating from one-half to one and a half tons of ore per hour; the finer ores requiring the longer time. Mr. Chubbs commenced his experiments in dry ore separating in 1852, and nearly perfected his machine in 1853, and applied for a patent in 1854; but owing to a controversy between Mr. Chubbs and Mr. Seymour, the patent was not granted till 1857, it being shown in the end that Seymour used water and Chubbs air. It is well known that there is a prejudice among miners against dry concentration, on the grounds that it is destructive to health and machinery; that a less amount of ore can be worked dry than wet; that it is more expensive; that the ores coming crude from the mines are usually mixed with slate and clay, and are quite wet, requiring to be dried; that in the treatment of most gold-bearing rock it had not generally been found advisable to reduce it all to a very fine powder or slime, but to a size so as to pass through, say a forty-mesh screne, than to concentrate the richer and heavier portions, and reduce them finer. In the treatment of gold he believed that full as much of the fine metal would be lost by the wet process as by the dry. He also stated that in the treatment of most silver ores, (sulphides of silver), since the crystals are very fine and firmly attached to the vein-stones, it has been found advisable to crush and grind the entire mass to the finest powder or slime, so that concentration, either wet or dry, has been shut out in the process. It has been said that experience shows

that concentration may be advantageously used in the treatment of the tailing, etc. The important feature of this machine is the application of puffs of air to the powdered ore. There have been other machines which work by straight currents of air. A globe of quartz and another of lead, if allowed to pass through water, will both reach the bottom at the same time. This is not so when the particles are reduced and passed through blasts of air, as when the ore is very fine it passes very slowly. The cost of a full size machine is $500.

Mr. Alanson Nash said that the fine gold that is found in the earth, when put into a rocker, often has that degree of fineness that the water will carry it down in the rocker, where it will be scattered away; so if very fine gold dust is subjected to puffs of air, much of it will be blown away. A metal so valuable as gold should all be saved, and hence the fanning process did not seem to be a good one.

Mr. Randall stated that water becomes turbid if shaken with gold dust in it, and it will stand for hours in that condition without settleing. The pans used in California are the best method for gathering the gold if mercury is used. In the treatment of silver ores, concentration is not advisable.

The Gulf Stream.

Prof. T. B. Maury spoke at some length on this subject, illustrating his remarks by frequent reference to large maps which he had provided. He said the subject on which he was to speak, was the great oceanic current known to geographers as the gulf stream. When Christopher Columbus crossed the Atlantic, he fell in with the celebrated trade winds, which commenced at the Tropic of Cancer, and continued in one unbroken belt across the whole earth, twenty-three degrees north of the equator, and thirty degrees south of it. It was in this portion of the belt that Columbus first met these trade winds. He found that day after day the wind continued to blow in one direction; and blowing as they do, I infer they carry with them a large portion of the surface waters of the Atlantic, and sweep them to the west. He also found that a large portion of the waters of the Atlantic follow the sun, moon and stars. These waters are swept up against the Windward isles, where it is split in two; a part known as the gulf stream, passing through the group of islands into the Caribbean sea; thence making the circuit of the Gulf of Mexico, passing up the coast to a point opposite Cape Hatteras, and then striking out to the western coast of Europe, and again northwardly along the Scandinavian coast into the

Arctic sea. The temperature of this stream, eighty-six degrees being its maximum, modifies the climate of western Europe, and tends greatly to produce the high state of civilization there. This stream moves with a velocity equal to that of the Amazon, and is in its volume three thousand times larger than the Mississippi. The easterly curve of the gulf stream (as shown on the maps), by which it is made to sweep toward the Azores and around to the shores of Africa, has no existence. There is a current recurring in this direction, but it is a mere drift. This is caused by the southwest winds, which everywhere on the globe north of the Tropic of Cancer are the same. The true gulf stream flows on in a mighty and resistless course. Even as far north as Hammerfest, in Norway, the most northerly town in the world, it makes its balmy influence felt. In 1831 the harbor of St. Johns, Newfoundland, 1,800 miles south of Hammerfest, had been frozen up as late as the month of June. But the harbor of Hammerfest has never been known to be closed by ice, even in mid-winter. This great body of water, called the gulf stream, has played the most important part of any in the world. This current of warm water, sweeping to the shores of western Europe, has built those gigantic human governments that we look upon with such wonder. It has changed the aspect of countries. This great stream, as it issues through the straits of Florida, has a temperature very near blood-heat, when it passes through the Gulf of Mexico, and is subject to the rays of the sun. But when it passes further north it has a heat of eighty degrees. To make a single estimate of the thermal power of the gulf stream, it has been demonstrated that if a vessel of any kind, as large as Wales, was filled with ice, that that ice would be melted in a single day. That is, the daily heat of the gulf stream, if utilized, would liquify a vessel of ice as large as Wales. The temperature of the gulf stream is only one element of that mighty water. The color of that water is another important feature of it. Its indigo color is most marked in some places, and the sailor knows the moment his vessel enters it by the color. The color of this stream maintains its specific character and distinction over all surrounding bodies of water. Sir. John Herschel states that the water gets its blue color from the reflection of its bottom. Whether this be so or not, is not yet decided. But if this theory be true, there should be a blue and a green color along the line of demarcation. Another important fact is the saltness of the stream itself. It is remarked that the water of the Adriatic sea, as it becomes salt and salter, becomes blue

and bluer, but this is not so, as it becomes redder. If the gulf stream derives its color from its saltness, why has it a dark blue. The gulf stream is swarming with life, with animalculæ. On a dark night, especially, it is illuminated with phosphorescent animals, and some of these, when thrown on the deck of a vessel, would explode. This stream is destined by God to accomplish some great work. What it is we do not know. It is isolated, it has no affinity with any other water. This great body of water rolls on as a river in the ocean. There are three great streams of cold water mixed in it. The water passes in layers all along over the Gulf of Mexico to the coast of England, and its temperature is preserved throughout. Dr. Franklin supposed that the trade winds had some influence on the gulf stream, but it runs directly against the trade winds, which never get a fair sweep of the gulf stream except in summer, just off the coast of Florida. On the map a similar stream is shown, the Black stream of Japan, off the coast of Formosa, which rolls on at the rate of four miles an hour. But if the gulf stream derives its power from the trade winds, why does it still roll on toward the north. The coast of England which should be as cold as the coast of Labrador, is as mild as the south at lands-end in England. We have the harbors of Europe kept open in the midst of winter by this mighty water. Another theory of the origin of the gulf stream is that it is caused by the annual fall of rain. Now, the depth of the rain that falls yearly on the surface of the globe is at least five feet. And this rain is mostly taken up by the equatorial regions. The belt of the stream is 3,000 miles broad, and 20,000 miles long. The specific gravity of this water is another point to be considered. The ordinary specific gravity is 1026, pure fresh water being 1000. We know that the Gulf of Mexico is a great cauldron of brine, and that vessels have to replace their copper after passing over the gulf. The specific gravity of this water all over is 1028, which is the heaviest of any water that has been found on the surface of the globe. Our books all tell us that the heavy cold water of the Arctic regions rush down to take the place of that of the equatorial regions, but at the same temperature, as we find that the water of the equatorial regions is much heavier than the Arctic. These are two great facts which bring before us the true phenomena of this great stream. If left to itself, the gulf stream would run due north, but the diurnal revolution of the earth causes a deviation. In 1868, just at the time when the gulf stream was causing considerable discussion, when the win-

ter was as mild as we have had it here, the Geographical Society of England was debating whether there was any such thing as a gulf stream. Some of the members said it was a myth. So we see that great men are not infallible. It is remarked by Dr. Kane in one of his works, that the gulf stream was traced as far as Nova Zembla, and he thought that this vast volume of water penetrated the Arctic ocean. And it would seem that there is something in this idea. It would seem impossible to stop this vast body of water, even by the immense ice fields of those regions. If the specific gravity of the Gulf of Mexico is greater than that of the Polar sea, it is a philosophical necessity that this equatorial water should reinforce that of lighter gravity, and thus keep open a portion of the surface of the Arctic sea. The theory advanced by Captain Dent has, of course, been dismissed; we know how jealous the human mind is, and those who have made voyages to the Polar sea, should reject the idea which would render their enterprise useless. That there is such a body of water, is a known fact, and that it has been traced from those regions to the offings of Hatteras. If we had a profile of the Atlantic, we would see that in some places the channel is very shallow, but when we pass to the Windward islands it is some 4,000 fathoms deep. The most distinguished geographers of Germany and England now call this vast expanse of water the canal of the Atlantic.

Many present, doubtless remembered the loss of the San Francisco, some few years ago. She was heavily laden with United States troops. After leaving New York she fell in with one of those heavy seas which are known to sailors as weather-breeders, these seas are just on the edge of this stream, and this vessel met one. There were two or three barks standing near her, which done all they could for her, and particularly one vessel, "The Three Bells," stood by her to the last, but night coming on the Three Bells lost sight of her, and when the morning dawned the captain of this noble vessel did not know where to look for her, and therefore hurried home. On reaching New London he telegraphed to Washington. A revenue cutter was immediately sent out to search for her; she was furnished with charts of the sea, telling at what point of the triangle the disabled steamer would be found, and in eleven days the point was reached, and the spars and pieces of furniture of the vessel were found still floating. Prof. Maury in reply to a question stated that the large physical atlas of Keith is the best we have.

Dr. P. H. Vanderweyde said, one of the benefits of this association is, that a discussion is always in order after a theory is broached. Mr. Maury says, that the gulf stream takes its origin from the coast of Africa. How can so large a stream take its course from there? Its real origin is the Pacific ocean; further back than the coast of Africa. The Indian ocean is a portion of the Pacific. (The Dr. further illustrated this point by tracing the course of the gulf stream on the maps.) The theory of Herschel is, that water like the gulf stream must seem blue, for the reason that the sky is blue. Any transparent matter that has no color must look blue. When a diver looks through water the color looks red. In the Mississippi river there is so much sediment we cannot see the blue. The waters of Niagara and Lake Erie are blue, and it is blue in mid-ocean. As to the rainfall, some three feet of water is carried up from this river ever year; but we must recollect that it rains as much down again. Mr. Maury, also states that the heaviest water on the globe is found in the gulf of Mexico; now we know that the water of Salt lake and the Dead sea are much heavier, but it may be that Mr. Maury refers to sea water. The water at the poles is heavy because it is cold, and the gulf stream water being warmer and lighter, flows on the top. It is very evident that the climate of England, Ireland, and Scotland, and other parts of Europe is much changed by the gulf stream. These countries would not be what they are were it not for this stream; so is the climate of California modified, and for the same reason. But we must not overrate the amount of heat carried over by the gulf stream; all the heat of this stream does not go out of it; it will give its heat according to the laws of connection. We must take into account that water possesses the most specific heat of anybody in nature, so in that respect the gulf stream is very powerful. As to calling the Atlantic ocean a canal he objected to that term, if compared with its width, it is a very small canal, it is rather a plateau. The whole amount of water-vapor that the atmosphere can contain at the same time is very little, suppose the whole atmosphere was saturated with water, and it came down all at once, the surface of the ocean would be raised only four inches!

Professor Phin stated that the greatest evaporation of the ocean known is in the Indian ocean, the monsoon regions. The annual evaporation is some eighteen feet. The average amount of rainfall is about five feet. Keith Johnson, it his atlas, says that the annual fall of rain on the surface of the globe is five feet. Colonel Sykes

states that at Chari Pungo he measured a rainfall of 60 inches, but this was in a southeast monsoon.

Mr. Alanson Nash remarked that the valley of the Amazon gives the largest rainfall of any place; whatever abstracts the moisture of the atmosphere will bring the rain down. There is no part of the globe that contains as much water as that section; this is owing to the proximity of the Chimborazo mountains.

Mr. Emery read a letter of Captain Dent, on the current of the gulf stream.

Adjourned.

February 17, 1870.

Prof. Samuel D. Tillman in the chair; C. E. Emery, Esq., Secretary.

Parallel Ruler.

Mr. Dudley Blanchard exhibited a parallel ruler made by him. It was intended for the use of draftsmen, and which would facilitate the cross-hatching required in making sectional views. Two parallel bars, intended to be placed in proper position upon the paper, are provided, one with a finger-lever and spring-pawl, the other with a ratchet on its upper surface, and with a hinged horizontal arm, adjustable at any angle to its bar. By working the lever on one bar, the pawl connected therewith is caused to act upon the ratchet of the other, and thereby advance the same, together with its angular arm or rule, to the distance required to form the spaces between the oblique lines of the cross-hatching, such distance being of course proportioned to the extent to which the finger-lever and its pawl is depressed. It is well adapted for ruling parallel lines of greater or less degree of fineness.

Deep Sea Sounder.

Prof. J. A. Whitney explained Mr. James Bogardus' Deep Sea Sounder, which was exhibited. It consists of a flat frame-work, the lateral portions of which constitute wings to prevent the instrument from turning bodily during its descent. Within this is a vertical spiral vane connected by clock-work at the top with an index finger, which, in connection with a suitable dial-plate, records the number of revolutions of the vane during the descent, and consequently the depth. The instrument is caused to sink by a weight at its lower

end. On striking the bottom, this weight is automatically detached, and at the same time provision is made for preventing any further rotation of the vane, whereupon the apparatus is brought to the surface by a spherical float at its upper end, no line being used with the device.

Dr. P. H. Vanderweyde remarked that it would be best if the float was formed of a number of small hollow glass spheres inclosed in a perforated metallic globe, inasmuch as these would resist the enormous pressure of the water at great depths much better than a single large sphere of the same floating power.

Prof. J. A. Whitney stated that Morse, in experimenting with globes, subjected hollow glass spheres to a pressure of some five tons to the square inch.

Mr. C. E. Emery said that Captain Trowbridge, of the United States Engineers, experimented with an instrument much the same as Mr. Bogardus', with the exception of the float. The long screw in Mr. Bogardus' apparatus does not work well in practice. Four blades of one-quarter the length of the one in this instrument would be much better. On Trowbridge's apparatus, which was much simpler than this, a catch was arranged to prevent the screw from turning when the float began to ascend. The instrument is used with a line.

The Chairman read the following interesting summary of scientific news:

Heat of the Stars.

Mr. Huggins has given to the Royal Society of London the results of a series of observations made by him for the purpose of determining whether a measurable amount of heat is radiated from the fixed stars. A thermo-electric pile was arranged so that its surface was in the focus of a telescope having an object-glass of eight inches aperture, and connected with clock-work which kept the image of the star on the face of the pile. When the telescope was directed to certain stars, the needle of the delicate galvanometer attached to the pile was seen to move after a minute or two, and when the telescope was held until the image of the star passed off the needle soon returned to its normal position. The mean of from twelve to twenty observations gave a deviation of the needle by Sirius of two degrees, by Regulus of three degrees, and Arcturus, after the lapse of fifteen minutes, of three degrees; that by Pollux was one and a half degrees, while Castor produced no perceptible movement of the

needle. These results are not strictly comparable, as it is not certain that sensitiveness of the galvanometer was the same in the whole series of observations.

On this item Dr. Vanderweyde remarked that we can scarcely concieve the distance that the stars are from us, so to measure their heat is a difficult matter with the instruments we have. The largest variation in the heat of the stars ascertained by the thermo-electric pile will probably be found only one degree of difference. Those having the reddest colors will no doubt have the greatest heat.

Mr. Charles F. Boyle, stated that the stars when seen through a slightly polished glass the lines assume different colors. When perfectly polished they appear all white. The stars disappear with different degrees of color as they descend; they decrease in the same order as the sun does when setting. A decrease in the power of the telescope will change the color of the stars.

Dr. Vanderweyde said there are a great many double stars that will appear different, even at the same distance from us. Some stars will show many dark lines in the red, and some in the green. The spectroscope shows these and also the shifting of the stars. He was now making diagrams of the colors of the stars, which he would show at a future meeting.

Hydrate of Chloral.

This compound has been subjected to numerous experiments in France since the first announcement that it possessed anæsthetic properties. It is formed by the action of perfectly dry chlorine gas upon pure alcohol. The hydrogen atoms liberated are not replaced entirely by chlorine atoms, since the chloral contains two atoms of carbon, three of chlorine, and one of oxygen. In a short time it undergoes a spontaneous change, but its hydrate is a crystalline solid. It has been successfully administered to persons suffering from nervous irritability, weakness and wakefulness. M. Bouchut, who has investigated its properties with peculiar care, says: "As a therapeutical agent, hydrate of chloral is the sedative of violent pain in gout, of the atrocious sufferings occasioned by nephritic colic and dental caries; in a word, it is the very best of anæsthetics *administered through the stomach.* Lastly, it is the quickest and most efficacious remedy in intense chorea, when it is required to abate speedily a condition of restlessness, which is in itself a peril to the life of the patient."

New Thermo-Electric Pile.

Messrs. Mure and Clamond, of France, have constructed a thermo-electric pile of sixty elements, each consisting of a bar of galena (sulphide of lead), about an inch and a half long by one-third of an inch thick, soldered to a plate of steel about two inches long by one-fiftieth of an inch in thickness. The shape of the bars and plates is such that twelve couples placed side by side, horizontally, form a ring, and five such rings, placed in a vertical line, complete the battery. The bars and plates are separated by means of thin sheets of mica, and the rings are isolated by washers of asbestos. The cylinder thus formed has an interior diameter of about two inches, and is firmly held together by means of two iron rings and three bolts. Heat is applied to it internally by means of a single Argand gas-burner, which consumes about twenty-eight cubic feet of gas per hour. It is claimed that forty of these elements have an electro-motive force equal to that of a single Bunsen element of the ordinary galvanic battery. If this claim is verified, the new pile may be regarded as an economical generator of electricity.

Dr. Vanderweyde remarked, the pile just mentioned was not as strong as the old one. Mr. Farmer, of Boston, has improved on this. He takes German silver, brass and bismuth. These alloys which give the best result are very brittle, and will not stand much jarring. This plan was used with some twenty pairs of piles, in which there was a stove in the center, that also served to heat the room. The apparatus was used as a plating battery.

Female Vocalists.

The different qualities of tone found among female vocalists does not depend on the larynx, the organ by which sound is produced. Modifications of singing speech are effected by the tongue, the movable osteous arch at its base, the tonsils, the nasal and buccal cavities and certain parts of the vocal tube. Often the form of the upper part of the body affords indications of pitch and range of the voice. The author of an article on "Parlor Singing," in The Atlantic says the length and size of the neck produce important modifications of the voice. Soprano singers, for the most part, have short necks and high shoulders. Women with very long necks and sloping shoulders have contralto voices, almost without exception. Hence we may explain a fact which often excites surprise, that many small and slender women have a low and deep-toned voice, which

should be distinguished, however, from one of a masculine character. A symmetrical form of the neck and shoulders produces a mezzo-soprano, or middle voice, which is most agreeable. All these different conformations of the mouth and frame give the voice its physiological character, which is also very considerably modified by temperament.

Successful Road Steamers.

It seems that the plan of covering the driving-wheels of a steam omnibus with a thick tire of India rubber has been found to obviate some of the most serious objections to using steam for locomotion on common roads; and steam wagons with this improvement are now manufactured in England. The London Mechanic Magazine thus notices the operation of this new locomotive: On Saturday last there was seen on the streets of Leith a wonderful team of mechanism. It consisted of a ten-horse power road steamer, with two companions of equal size in tow to the docks for shipment. To those who have been in the habit of seeing heavy machinery dragged along by some sixteen or eighteen horses, and who have witnessed the kicking, plunging, swearing and uproar which invariably accompany such undertakings, it must have been pleasant to observe the quiet smile of the driver's face as he silently picked his way along the streets. Although the roads were in the worst possible condition, being thick with greasy mud, the journey to the ship's crane was effected so smoothly and easily that it did not offer a single incident for description. All that can be said of it is that it was the simplest performance in the world. The road-steamer, which was acting as a tug to its two mates, was exhibiting its maiden efforts, as it had only just been completed and had never been out before. It was a ten-horse power engine, nominal, but can develop up to thirty-horse power. The diameter of the wheels is six feet; the breadth of the India-rubber tire is fifteen inches, with a thickness of four and one-half inches. The inventor of this improvement is Mr. R. W. Thompson, and the manufacturing firm working under his patent have already received numerous orders for the new road locomotive.

Preservation of Stone.

Dr. Robert, in the Paris Les Mondes, maintains that the use of the black oxyd of copper, and its salts, will effectually prevent change in stone. He shows that the decay of granite, marble, limestones, sandstones, and all natural building stones, is the combined effect of

various causes, and that among these is a very minute litchen, the *Lepra antiquitatis*, which is one of the worst enemies of stone; and its action is to such an extent that, for instance, the beautiful marble sculptures of the well-known Parc de Versailles will, unless proper measures be taken for staying the process of decay, be unsightly and ugly masses of dirt, and quite irretrievably lost, as works of art, within the next fifty years. The author, taking as instances such buildings at Paris as the Bourbon Palace, the Palais du Corps Legislatif, the Mazarin Palace (l'Institut), the Mint, and others, points out that dust, spiders' webs, and the action of rain, combined with the minute lichen above alluded to, hasten the decay of stone, especially of those parts where any sculpture or ornamental carving promotes the deposition of dirt and dust. Various places and instances are cited of the application of oxyd of copper and its salts, which places are open to inspection, and the length of time which has elapsed since such application, seems to warrant the conclusion that these compounds act as preservatives of stone. In reference to granite, the author states that this stone is also, according to the experience of Egyptian engineers, far more readily affected by a moist climate than one would be led to believe. The obelisk of Luxor, brought from Upper Egypt to Paris, has become blanched and full of small cracks, during the forty years it has stood on the Place de la Concorde, although forty centuries had not perceptibly affected it as long as it was in Egypt. Granite, in a moist climate, becomes the seat of minute cryptogamic plants, which greatly aids its destruction; and it is, moreover, a well-known fact, that the disintegration of this stone, which is composed of three separate minerals (quartz, mica and feldspar), depends very greatly upon the thorough and intimate mixture, as well as the chemical composition of these three ingredients, each of which, in a separate state, more easily withstands the influence of the weather.

Is the Potato Disease Hereditary.

A correspondent of an English journal of horticulture says he planted in 1865 some pink kidney potatoes of a late keeping kind, called Yorkshire kidneys. They produced much haum, and are a little given to disease. The crop was diseased. He selected from the diseased potatoes twelve of the very worst, so bad, so rotten, as scarcely to have any vitality, and planted them, in March, 1866, on a piece of poor ground without any manure. The result was

seventy-one potatoes quite sound and fifteen diseased. In 1867 he planted the diseased potatoes and a few sound ones, sufficient to make a long row; the result was scarcely any disease at all. In 1868 he planted two rows, taking all the diseased and small potatoes; the result was a good crop, and no disease. On the 21st of April, 1869, he looked over the potatoes left, about half a bushel, and could not find a trace of disease.

New Process for Extracting Copper from its Ores.

Dr. T. Sterry Hunt and James Douglass Jr., have invented a process for separating copper from such of its ores as are in the state of an oxyd or semi-compound thereof, as oxychorid or carbonate of copper. They claim: 1. The use of a solution of neutral protochloride of iron, or of mixtures containing it, for the purpose of converting the oxyd, or suboxyd of copper, or their compounds, into chlorides of copper. 2. The use of sulphurous acids for the purpose of decomposing the oxychloride of iron formed in the preceding reaction. 3. The use of a process for the purpose of extracting copper from its naturally or artificially oxydized compounds by the aid of the first, or the first and second of the above mentioned reactions.

In relation to this item Professor Stevens said, that nine-tenths of the copper ores of the United States, were of inferior grades.

Curative Properties of Petroleum.

A London medical journal reports a number of cures in East Indian hospitals by the application of petroleum in combination with other materials, to form a consistent ointment. Petroleum is found to take the place of carbolic acid as a local disinfectant. It has been successfully used, also, by American physicians, and has long been sold in this country as a "patent medicine" under various names.

Mucilage.

A preparation is now used in England, on what are called "safety envelops," which is made from thick, tough sap found in large quantities in the leaves of the New Zealand flax.

New Actinometer.

Bunsen and Rosco have prepared a paper of standard sensitiveness which varies in tint exactly in proportion to the length of time it is exposed to light. Such paper can be used in countries where

the power of sunlight is very variable, for determining how long exposure will be required to produce a photograph.

Hot-Air by Wholesale.

A gentlemen who has been for many years engaged at the United States Armory, Springfield Mass., is now making experiments to ascertain whether it is feasible to supply an entire city with heated air. He proposes to heat the air by means of iron and fire clay pipes to about 600 degrees Fahrenheit, and to force it through tubes, covered with a non-conducting substance, to the place where it is to be used. The first trial will be made with a pump of eight-inch diameter, which is to force the heated air through a series of clay tubes of four-inch bore for a distance of 300 feet. We infer that the projector of this plan supposes that, by heating the air to a very high temperature, he will be able to diminish greatly the quantity of air to be moved, but a little calculation will prove that even this arrangement will not enable him to supply a city with warm air, even from a dozen different sources. It is, however, possible to heat a connected square of buildings, bounded by four streets, by means of steam-pipes, with less expense, less danger from fire, and far less danger to health than by the transmission of hot air.

Proposed Ship Canal.

A ship canal through the narrow neck of land separating Buzzard's bay, from Cape Cod bay, Mass., is about to be commenced. The canal will be five or six miles long, 300 feet wide, and twenty-four feet deep at low water. This improvement will shorten the passage of vessels between New York and Boston several hours, and enable their navigators to avoid the open and often stormy sea encountered in the voyage around Cape Cod.

Navigable Passage Through Perpetual Ice.

The Russian papers announce an important discovery by Cartson, a learned Norwegian, which will give a great impetus to Siberian trade. He had cruised, for scientific purposes, in an expedition undertaken last summer in the Karian sea, which washes the southern part of the isle of Nova Zembla, and the government of Tobolsk, and is covered with eternal ice. In this ice a passage was discovered which, for several months in the year, offers a convenient path for traffic between Siberia and the Norwegian harbor of Iromsoe.

New Food for Infants.

M. Nestle of Vevay has prepared a new food for infants, called *lacteal farina*, which is composed of perfectly pure "condensed milk," of sugar, and of bread after it has been submitted to a high temperature; these are mixed in certain proportions to produce an article of diet similar in composition to human milk. The College Courant, after noticing the above, adds: "If some other benefactor of his race would supplement Monsieur Nestle's contrivance by a patent automaton to administer the maternal fluid, wonderfully results might be obtained. The old and tedious system of bringing up orphans by hand would be superseded, fashionable mothers would be relieved from the onerous task of nursing, and no one can doubt that the crop of aristocratic infants would be largely increased in consequence. It would only be necessary to consign the babe to the tender embrace of the machine, fill the tank with 'lacteal farina,' connect a hose provided with a valve opening outward, place the end of it within the youth's reach, and instinct and suction might be relied on for the rest. By judicious apportionment of the aqueous and lacteal elements of the mixture, moreover, a fat or lean article of children—according to the taste of the doting parents—could be produced to order."

New Mode of Setting Boilers.

Some of the boilers of Sheffield, England, have been set upon a new plan. It consists of an arrangement of fire clay plates, by which the gases are thoroughly intermixed at four successive stages in their progress through the flue, and thrown in thin streams against the surface of the boiler. The capacity of the flue is not contracted, yet no part of the gases can escape this repeated, forcible contact with the boiler, and in the process the heat they contain is so nearly absorbed by the iron of the boiler that a series of careful tests show an average evaporation of twelve pounds of water for each pound of bituminous coal used. The improvement can be applied to any ordinary boiler without resetting it, and the fire clay plates can be furnished at so moderate a cost that the expense is soon repaid by the saving of fuel.

Mr. C. E. Emery said that any plan that served to break up the currents of a flame will undoubtedly have a good effect. We are taught by practical experience that it is of value to make a number of bridge walls under a cylinder boiler, forming several chambers into which the gases expand, and then turn up again in forcible contact

with the boiler. The utility of such a contrivance is seen, when a mass of flame or heated gases is passing along a flue, the exterior portion, near the heat absorbing surface, becomes cooled, while the interior of the current retains its high temperature, radiation not being sufficiently rapid to cool the whole uniformly. If then by any means the current be broken up so that the hotter part of the gases is continually brought near the metal, the evaporative power of a given amount of surface is greatly increased, thus producing economy of fuel. To accomplish the same result without such appliances, the amount of heating surface, and consequently the size and cost of the boiler must be increased until surface is provided to absorb the heat under the more unfavorable conditions.

On the Geology of the South American Continent.

Professor R. P. Stevens read a paper on this subject. Geologists are at the present time divided into three great schools, viz: The catastrophists, the evolutionists, and the uniformitists. We leave out of our count, those, if any, who still hold to miracles.

Of the three great schools, not one alone is able to explain all the phenomena attending and connected with the growth of continents. The eclectic geologist is the inner man, who selects from each and all, and therefrom builds his theoretic structure.

The first postulate I assume in the treatment of my subject is, that there has been nothing new of material added to continents since their first appearance above the surrounding oceans.

The second postulate is, that the original material has undergone changes in its aspect, and suffered new combinations, and been removed and laid down in new localities. The continent of South America presents the simplest form of continental growth and change. It is therefore selected to present our views on the dynamic forces which have formed great continental areas.

The primary form of this continent, we think, was pretty much as we now see it, viz: A great and somewhat irregular triangle. During this stage of its history were laid down crystalline rocks. Such as gneiss, mica and hornblende, slates, and intruded dykes of granite. It is during this stage of its life that the theory of catastrophy will apply to it. How else can we explain, that all rocks of this age over the wide world, always stand upright. They bear internal evidence of having been formed from pre-existing material, to have been laid down on some level shore or ocean bottom, and afterward upheaved and left in a more or less vertical position, never in a horizontal.

In this stage was probably thrust up the great range of the Andes, in double and parallel lines as far as Chimborazo, and there dividing into three great branches.

The mountains of Guayana were also at this time elevated and perhaps some of those of the eastern coast of Brazil. From this time onward, through every succeeding stage of its growth, these mountain ranges have formed the axes of oscillation for the rest of the continent. They have themselves undergone subsidence to receive ocean deposits upon their slopes and foot hills.

The first great period of oscillation and partial subsidence we shall call the Paleozoic, extending from the silurian to the close of the carboniferous eras.

Very much the largest portion of the continent stood firm, a small portion of the middle, viz., Bolivia, part of Paraguay and part of Brazil. Exactly how large these areas were we do not know. We are dealing with fragmentary history, and cannot speak with precision. They may have been much larger than represented upon the Paleozoic map. The next great period is the Mesozoic. In this the axes of oscillation were changed. The Guayanas, much of Brazil, the entire range of the Andes, and many local points in Buenos Ayres stood firm, while the great plains of the continent subsided beneath the ocean and received deposits from abrasions and detritus of the older portions. We see Brazil retaining its present contour, but much abbreviated of its territory.

During this stage of the growth of South America, it presented a long narrow rim of land on the west, connected with the large islands of Brazil. There was an archipelago of islands in the north, much like the West Indies, and a smaller group in the south.

My third great division of the growth of this continent is the dilurial. This is confined mostly to the valleys of the great rivers, and the coast line of Brazil, north of the Amazon, and Cape St. Rogue. The coast of Guayana, the delta of the Orinoco, the Lakes Maracaibo and Titicucu, and a narrow shore line of the Pacific. It is but a small fragment of the continent, but of great importance in studying the laws which have controlled the changes this continent has undergone, and the agencies which have produced them.

A glance at a well executed physical atlas will show that this last addition to the continent has been made by causes now at work. Atmospheric and other agencies cause decomposition of rock masses and all land elevated above the sea level. The rains of heaven cause

this decomposed material to be washed down into lower lands. By these means the lower lands are gradually elevated. As the valleys through which rivers run narrows upon them, their currents increase in swiftness, and more material is carried into the sea and deep water, and deposition takes place along shore lines.

Hence you see, that on the map of the dilurial, the growth of the continent has been along the great inland waters, and the ocean contiguous to the mouth of great rivers. From Cape St. Rogue to the Amazon the coast line has been modified by the constant setting in of currents from the Atlantic carried by the trade winds. From the mouth of the Amazon on to the island of Trinidad the wash of this river and the Oronoco have contributed to build the shore line out seaward. The same remark applies to all other streams. The wash of the Andes has enlarged by a very narrow strip the coast line of the Pacific.

From this rapid survey of the great changes of the continent during the diluvial period, I think we can learn the agencies that contributed to build this continent in geological ages, such long time past no horologue can measure.

They are briefly these:

First. Molecular decomposition of rock masses by chemical, atmospheric and other agencies, sub-aerial changes.

Second. Removal and transportation of this decomposed material by the agency of flowing water; and

Third. Redeposition of this material by change of velocity of transporting currents, and to dull action.

There remain for discussion the dynamics, which have thrust down large continental areas to receive depositions from the sea, and re-elevated them to become again dry land.

May we expect that henceforth the growth of the continent shall be seaward, and that the streams flowing outward, from south and north American continents, aided by detritus of the West Indian Islands, shall fill up the Caribbean sea and all the channels between the island, the Gulf of Mexico, and, finally, the two continents become one, not by the present narrow belt, but a new, noble, large and rounded out-growth? These are questions for the coming geologists.

Adjourned.

February 24, 1870.

Professor S. D. Tillman in the chair; C. E. Emery, Esq., Secretary.

Hydrostatic Atomizer.

Mr. C. Hodge, Hudson, exhibited his atomizer; he said: Since fluids were first atomized for local anæsthesia, various more or less perfect methods have been adopted for the purpose. The more common apparatus consists of India rubber bulbs, so arranged that while one acts as a bellows the other is designed by its elasticity to keep a constant and equable pressure. Although excellent in theory, practically it frequently disappoints; for besides other defects, it requires an assistant, and it is almost impossible for one person to keep up a uniform current for more than one or two moments, on account of the extreme fatigue to the muscles of the hand in working it. Steam has been used, but of course is not always available, and has its obvious disadvantages. The hand air or force pump has been employed, but this also necessitates an assistant, even for the slightest operation. To obviate these and other defects, hydrostatic pressure has been resorted to, and apparently with most satisfactory results.

The apparatus consists of two closed cylindrical vessels, each capable of holding one or more gallons of water. On the side of each, close to the bottom is a short tube with an aperture not exceeding five-eighths of an inch in diameter. At the top of each is a stop-cock of one-eighth of an inch delivery. These apertures may be varied in size according to the size of the vessels. The stop-cocks being closed, one vessel is filled with water. The two vessels are then connected by a flexible tube, the larger aperture of the one with the larger aperture of the other. The atomizer is connected by means of a small flexible tube with the stop-cock of the empty or air vessel. The vessel of water is elevated and both cocks are opened, the water will, of course, displace the air in the lower vessel, and force it through the atomizer. Sufficient pressure is secured by an elevation of ten feet, and the height of an ordinary room answers very well. When the air has been entirely displaced in the lower vessel, the atomizer is changed to the empty vessel, and the position of the vessels are reversed, the fountain is then renewed without the escape of a drop of water. The principle here involved is familiar to all.

Dr. Richards approved of this method very much, and made diagrams on the black board of Richardson's improvements on the Clark blowpipe for atomizing.

The Chairman remarked that this was entirely an American invention. The principle is fully explained in Ewbank's hydraulics. Mr. Ewbank states that a tube made like the atomizer would draw up mercury in it seventeen inches, or about three-fifths of the column measuring the weight of the atmosphere. It was on this principle that the Gifford injector was constructed. Some twenty years ago Mr. Ewbank applied this idea in this country to cause a draft in chimneys.

Dr. J. J. Edwards said that one of the difficulties in dental anæsthesia is that the gas cannot be given without assistants, and then it tries the patience of the operator before the teeth are taken out. The atomizing process is a great improvement on the anæsthetic method, and the plan here shown which dispenses with assistants is valuable. It is an economical machine; one man can use it without any difficulty.

Dr. P. H. Vanderweyde said the atomizing blowpipe, made on the principle of the Giffard injector, was used by him as a pump for steam fire engines, but was found not to have the power of the pump, and so was abandoned. This principle is used quite extensively; the latest application is to "age" whisky with it. We all have doubtless heard of the recent case of a wine cellar being struck by lightning and scattering the wine in all directions, which after being gathered up was found to be much improved, but the improvement was nothing more than bringing the air to the wine. The loss by evaporation of the wine by aerating it, is said to be trifling. A patent for improving wine by electricity, has been granted, but it is not done like nature as a galvanic battery is used. He employed a pump on this plan of the blowpipe to water flowers.

The Chairman remarked that the Gifford injector carries the heat of the steam used back into the boiler through the water injected, and in this case is not a wasteful application of steam. For other purposes it might do to use the waste steam to be blown off into the air; in this way only it is economical.

Pressure and Vacuum Gauge.

Mr. W. H. Chase exhibited the American Eagle Steam Pressure and Vacuum Gauge. This gauge, he said, in the simplicity of its construction and strict reliability, is placed next to the syphon or cistern mercury gauges, which are known as the only gauges entirely reliable in their indications. This gauge is a mercurial steam gauge, which can be easily adjusted. The diaphragm is nickle plated, which

does not become deteriorated by use. A spring does part of the work, and the mercury the rest. The mercury is put in the chamber, and as the pressure acts upon the diaphragm, the mercury is forced up in the glass tube, and the scale on the guard of the tube will indicate the amount of pressure.

Mr. C. E. Emery said that this gauge was almost exclusively used on the boilers at the late fair. It gave much satisfaction, and possesses the advantage of the mercury gauge without the disadvantage of the spring gauge. The range of the pressure is never beyond the elasticity of the diaphragm. This matter of corrosion has been the difficulty with all other diaphragm gauges, which the nickle plating obviates. This instrument has to be placed in the engine room, where the temperature is always about the same, and there adjusted at zero.

Dr. D. D. Parmelee said that the coating of the steel plate with nickle was a highly important improvement.

The Chairman remarked that the nickle plating was the only point of improvement in this gauge.

STEAM BOILERS.

Mr. J. K. Fisher read the following paper on the best form of steam boilers:

"Since the introduction of the multiflue boiler, in 1829, and the water-tube safety-boilers about the same time, there have been such changes of proportion as have prevented the generation of dry steam in most boilers. Two of these changes are in the proportion of steam room, and in the proportion of water-level, to the volume of steam produced. Watt's proportion, for large boilers, was about one cubic foot of steam room for 300 feet of steam made per hour. A common proportion now adopted in locomotives is one foot of room for 900 feet of steam per hour; and there are boilers of other kinds in which the steam room is much less; and this excess of volume is aggravated by greater density—nine or ten times greater than Watt used. In steam so dense, particles of water will not fall so rapidly as they do in steam of one atmosphere, or a little less, such as Watt used. These changes have been made in consequence of a demand for lightness and compactness, and not in consequence of careful trials to arrive at the proportions necessary to make dry steam. On the other hand, Watt disincumbered himself of all that stood in his way, and planned his boilers strictly with a view to make steam per-

fectly and economically. He gave up the idea of high pressure, to which he had been attached, so that he might use a spacious but weak boiler, of such form as would receive heat well, and contain ample steam room and water-level. And the proportions which he established are entitled to the highest confidence, because his whole time was devoted to the perfecting of his engine, the manufacture being left chiefly to his assistant, Murdoch, and the commercial management to his partner, Boulton. It was a new subject, requiring new investigation throughout; and he, of all men in the world, was best endowed with the genius and experience necessary for such investigations; and the settled policy of the establishment was that he should pursue them without interruption by other business. To neglect the rules laid down by him, as the results of his studies, experiments, and practice, is injudicious in all cases in which there is no special constraint. In locomotives and in marine boilers there is such a constraint; but in stationary boilers there is no absolute need to make the steam room and water level less than he did. Yet, biased by the surprising efficiency of the multiflue boiler in its various forms, engineers have almost entirely disregarded those rules; and the consequences have been priming, priming-boxes, superheaters, excessive throttling, and costly apparatus to remedy the disease; and with all the remedies there is an acknowleged excess of water in the steam from most boilers, amounting to from six to forty per cent; and in some cases boilers have been made so deficient in steam room as to be utterly impracticable and unusable, and useless until relieved of part of their tubes.

"But of all boilers the worst, in deficiency of steam room and separating surface, are the safety-boilers made up of small tubes, with the water inside. Ogle & Summers' steam-carriage boiler could not be worked at less than 240 pounds pressure; and Dance & Field's steam-carriage boiler wasted so much water that it was practically inefficient. And we have now before us boilers unexceptionable as to safety, which are so defective as to dryness of steam that they cannot do hard work with economy, and are not likely to supersede unsafe boilers, except in cases where explosions would involve unusual losses. At various times I have recommended this class of boilers, on account of their safety; and I think no prudent person will say that they are not entitled to preference, notwithstanding these defects; but they ought to be made as good as any boilers, in economy, and security against minor derangements.

Influenced by these views, I have attempted to devise a remedy for the notorious moisture of steam in the boilers of this period, especially those which, for the sake of safety, are made up of small tubes or spheres. And I have settled down in the belief that the true remedy is in conforming to the laws of nature which Watt discovered and taught, namely, that a certain amount of steam room and of separating surface must be given to insure dry steam. If a superabundance of water-level be given, less steam room will suffice; and if a superabundance of steam room be given, less water-level will suffice; but how much of the one will atone for a given deficiency of the other, is a question which I propose for discussion. If trials show that a greater proportion of steam room is necessary to the best effect, there are three means of getting it: First, the generating tubes may be larger; second, the water may be carried lower; and third, the pressure may be higher, so as to reduce the volume of steam. In cylinders, the water-level and the heating surface increase as the diameter, while the steam room increases as the square of the diameter; hence the proportion of steam room increases as the diameter. Therefore, if we wish to produce a greater volume of steam, we must proportionally increase the diameter of the tubes in which the steam is made. The tubes here shown are seven inches, and the pressure is 140 pounds, and fifteen square feet of heating surface is allowed to vaporize one cubic foot of water per hour. Suppose that we have to increase the firing to do more work, we must increase the pressure; that is, we must keep the volume of steam constant, or we shall have damp steam. If so high a pressure be disapproved, and it be required that the usual pressure, seventy pounds, be adopted, then the tubes must be fourteen inches to make steam equally dry. I do not here make allowance for the density of the steam, and its effect in buoying and carrying particles of water, because I know of no experiments to determine that part of the question, and because it is not necessary in order to prove the superiority of the system I am advocating.

It is obvious that these rules favor a diminished volume, that is, a higher pressure of steam; all modern boilers require a high pressure to keep water in them; and all will make dry steam if the pressure be kept so high that not more than 300 feet per hour shall be made for each foot of steam room. But the pressure requried by this condition could not be borne with safety by large-shelled boilers; the tubes here shown will bear six times more pressure than the shells of

locomotive boilers; and, with only the thickness now adopted for durability, tubes may safely be worked at 1,000 pounds pressure until they fail from partial corrosion and leakage. And this type of boiler, which has the water in small chambers, brings up the question of pressure disincumbered with the question of safety. We can work safely with any pressure now contemplated; and the higher the pressure, the better for the boilers as to the quality of steam.

"Fairbairn has for many years recommended increased pressure, and has said that he expects to see 500 pounds used. Alban has worked up to 1,000 pounds, with no disadvantage but the decomposition of the hemp packing of his piston. Perkins, with metal packing, for a long time worked at 1,500 pounds pressure. In a few cases in this country, locomotives have been worked at 200 pounds, and steamboats at 250 to 300. The chief trouble apprehended is that the side-valves will have too much friction, under extreme pressures, and will cut their seats. But there are balanced valves that promise relief from this; and, up to a high limit, not yet reached in locomotives, the friction of the valve decreases as the pressure increases.

If we increase the pressure we may decrease the diameter of the tubes. If seven-inch tubes will make dry steam at 140 pounds, with fifteen feet of surface per cubic foot of water per hour, $3\frac{1}{2}$ inch tubes will make dry steam with 280 pounds pressure. But four or five inches is the least diameter that we want to use, having cost of construction in view. We may say, then, that if we adopt 250 to 300 pounds pressure, which has been used without harm to the engines, we may, in tubes of economical size, and with perfect safety, fulfill the conditions which Watt laid down for his own practice, after careful trials, in which he was not embarrassed by the questions of safety, weight, compactness, or any of the difficulties that have arisen in marine and locomotive practice.

The means by which I propose to extricate the steam from the water, so that it may not carry water with it, are, first, a separate water level in each tier of tubes, so that in each tube there shall be an ample separating surface and sufficient steam room; and, second, a sufficiently wide and deep passage for the steam, so that it may move over the water so slowly as not to ripple it, or drive away bubbles, or in any way take up particles of water. There are forty-eight tubes, seven inches diameter and seven feet long, arranged in eight tiers over each other. These tubes are screwed into a flat box, set on end. The box is divided into eight stories, by floors which are

turned up at the ends, so that the water is kept at the required level, say, up to the middle of the tubes. The water enters the upper story, and fills it to the required level, and then overflows into the next story below, and so on until the lowest story is filled to its proper level, as shown by a gauge, and regulated in the usual way. The water overflows on one side, and the steam flows off on the other side, the floors being upturned higher on this side, so that no water may go over with the steam. A heater, kept full of water, may be placed above the boiler, or it may be in a separate compartment, through which the smoke may pass, downward or sidewise. I think it best to give the smoke only an upward movement, and for that reason I put the heater above the boiler; but in this case the pipe which connects the heater must dip under the surface of the water in the upper story, so that the heater may be kept full of water. And to provide for cases in which steam may be made in the heater, such as when the pump is stopped, there are dams in the heater pipes to prevent the water from running out; only a tenth or less of the water can be driven into the boiler; and the steam made in the heater will go down into the boiler mixed with more or less water.

There is one point which, it appears to me, is favorable to high pressure in boilers whose tubes are exposed to flame; the density of steam, I think, increases its heat-receptive power. If we use steam of three times the usual density, it will take up heat much faster. How much faster I do not know, from any reports of experiments. But I conjecture that its receptivity is as its density multiplied by the difference of temperature between the steam and the iron. The temperature of the iron, in heaters for air, Tredgold assumes as a mean between the external air and the smoke. I doubt his accuracy, and think that he should have considered the densities of the cold and the hot air or gases. But it is idle to attempt, without experiment, to learn precisely how much density may affect the receptivity. In case of atmospheric pressure, there is probably not much error in assuming that, with thin plates, the temperature of the surfaces covered with water is very nearly that of the water; and the temperature of the surfaces in contact with steam is a mean between the temperature of the steam and that of the flame or smoke. But if the density of the steam be ten or twenty times greater, I believe it will take up heat so much faster that the metal will be sufficiently protected against heat, even if the steam be dry.

The advantages of high pressure which are made available by safe

boilers are, as to the boilers: the quantity of water is less, so that the time and fuel required to get up steam may be considerably economized; the volume of steam is less, and the water is more solid, and takes up heat faster than water mixed with more foam. Williams says that the receptivity of plates covered with water is 10, covered with foam, 8, and covered with steam, 6; and the room occupied is less; and the cost of small lap-welded tubes is much less per square foot of surface than that of large ones. Against these, it may be said that the smoke from a high pressure boiler will go away hotter: but this would improve the draft; and it need not go away hotter if the heater be arranged so that the coolest water is exposed to the coolest smoke. The advantage, as to the engine, is that expansion may be carried out more advantageously. And there are now, in England and in this country, engineers of high reputation who are working on the Woolf system, of high and low pressure cylinders. This system will be the more effective if we increase the pressure to 300, 400, or 500 pounds. The external surfaces of tubes are greater than the internal; and, as the surfaces exposed to heat determine the rate of vaporization, the cost of tubes will be less than when the smoke goes inside. Lastly, tubes that are staggered and have the draft across them makes one-half more steam than when set in rows, and probably much more than when used as flues. And as to the danger of burning the upper half of a tube that is but half full of water, it must be observed that the upper half receives but a quarter of the heat in any case, and less when the tubes are staggered. D. K. Clark reports an experiment with a square flue, in which the upper surface, with water on it and heat under it, made as much steam as the two sides, and the bottom made none at all. From these facts I infer that the upper halves of the tubes would be of little use—about a sixth of the whole—in making steam if covered with water, and that they will not be burnt. And their use in superheating or drying the steam will be greater than their use in making saturated steam. There will be no loss in leaving the upper halves of the tubes uncovered by water, as I think; but water may be carried higher if the tubes be larger."

Adjourned for two weeks.

March 10, 1870.

Prof. S. D. Tillman, in the chair; Robert Weir, Esq., Secretary.

Steam Boilers.

The Chairman remarked that the ordinary course of proceedings would be changed this evening, in order to give all the time possible to the discussion on steam boilers.

Mr. James Montgomery then took the floor and spoke at length on the construction of steam boilers, and pointing out what he considered erroneous modes, especially those which did not provide for a constant circulation of the water within the boiler. He explained the construction of his well-known boiler which had been in practical use many years. It was an improvement on the celebrated boiler of the late Dr. Eliphalet Nott, formerly president of Union College. In Dr. Nott's boiler the flame and heated gases were brought in contact with small tubes containing water. The effect was to carry the water rapidly to the upper part of the boiler, which was supposed to find its way back toward the bottom of the boiler through the water tubes near the shell of the boiler; but experience had shown that the water did not return readily through these tubes, and the consequence was numerous explosions. He claimed to have overcome the difficulty, by making separate passages for the descent of the heated water, which passages were not in contact with the fire. He used vertical water tubes, and placed a diaphragm between the tubes at about half their height, and caused the flame and heated gases to first strike the upper part of the water tubes, and then descend and return between the lower parts of the same tubes, thus economizing the heat. The water was found to circulate with great rapidity in his boiler.

The Chairman stated that a very simple and effective mode of producing circulation in boilers containing upright fire tubes, had been patented by Mr. Hicks, which consisted in inclosing the upright tubes in a cylinder of thin metal, placed at such distance from the shell of the boiler as to allow the water to descend freely between it and the shell. This seemed a cheap and simple mode of securing a rapid circulation of water in boilers of otherwise old style of construction.

In response to queries, Mr. J. K. Fisher said that linings and diaphragms used to aid circulation were invented by Jacob Perkins,

and used by him and several of his pupils, and by others. The upright boilers of the dummy locomotives of the Hudson river railway, built in 1858 and 1859, have cylinders around the tubes to separate the downward from the upward currents; the down flow of solid water is between the shell and the insulating cylinder, and the upflow of foam is among and around the tubes. This arrangement was directed by Mr. A. F. Smith, then superintendent of the Hudson river railway. He had also put circulating plates in the legs of locomotive fire-boxes, and experimented with adjusting screws, by which the plates were put nearer to or further from the heating surfaces; and he found considerable advantage when the circulating plates were well adjusted. Field's tubes, now much used in England, are Perkins' tubes improved by shaping their upper ends like bells; they catch the solid water more freely. Mr. Joseph Nason, of this city, a pupil of Perkins, has more effectually improved these tubes by elbowing their upper ends, so that they take solid water from the lowest level above the tube-sheet. The Seneca Falls fire engines have Perkins tubes, and work well; but all these pendent tube-boilers require stays between the tube-sheet and the head-sheet of the boiler; and, like other fire-engines, to make it easy to raise steam quickly, the Seneca engines have little water in them—that is, their tubes are small; they would be better, for common use, if the tubes were twice as large.

Mr. G. H. Babcock remarked that the boiler of Mr. Hicks, described by the Chairman, was a good one for upright boilers, but was not original with Mr. Hicks. It was used some years before Mr. Hicks' patent, and was placed upon the steam-tug Montauk in 1862, and he had himself used it in many boilers before the date of Mr. Hicks' patent. It is similar to Perkins' apparatus. Mr. George H. Corliss has invented a boiler which consists of seven vertical boilers in a nest, six filled with tubes surrounding a center one without tubes, and connecting thereto at top and bottom. The fire is in a circular furnace the whole size of the nest. These boilers were put on board of the steamships Nightingale and Weybosset, but foamed so when the water became salted as to give trouble. This was also the case in Providence, where it was found that these boilers were defective, and Mr. Corliss advised the engines to be changed; but this appeared to make but little difference. At the Wamsutta Mills there was six of these boilers, and they are spoken of very highly, and say they do not want anything else. The old English boilers in which the water

passes down in a circuitous direction, was tried, but it was found that the bottom of the water was cold and the top hot. This was due to the unequal expansion. The Perkins' boiler, spoken of by Mr. Fisher, are the best that can be used. He had seen one of them working where the steam blew right through, and he also noticed the gauge cock raise ten pounds in ten minutes. No other boiler could be made to do this. The importance of a good circulation in boilers to secure an equal temperature, and thus remove one of the principal causes of explosion, is not sufficiently understood.

Mr. C. E. Emery said the subject of circulation of water in boilers is a very interesting one. Let us take the simplest form of boiler, and see how inventors have undertaken to remedy its defects. In practice, the currents go up on the sides and bubbles of steam, would tend naturally to rise; but the water is also tending to take its place, and, unless the surface is sufficiently extended, the circulation will not be perfect. In the plain form of cylinder boiler the currents go in two directions. In the tubular boiler the steam rises up between the tubes and on the sides; but the greatest heat is at the crown sheet. The water rises up through the tubes, and higher at the front end than the rear, and in this manner it moves downward. This is determined by water gauges, which prove that the water is higher at the front than at the back of the boiler. The great difficulty in this form of boiler is the want of circulation. In another form of boiler the tubes are screwed into a larger one, lying horizontally, the sealed ends of the smaller tubes being a little lower than the ends opening into the larger tube. The water level is adjusted to half fill the larger tube, and completely fill the smaller ones at their sealed ends. Tubes sealed at one end are often set inclined, and entirely below the water level, with their open ends connected to a front chamber. Alban, a German engineer, in his work on the steam engine, says he made such a boiler many years ago, and provided means to introduce the cooler water into the bottom of each tube, and take out the hot water into a separate channel at the top of each; but he had no way of producing positive circulation in the tube itself. Sargent, in this country, uses a similar arrangement of tubes, but places in each a diaphragm, extending nearly the whole length, the water expected to pass down above it and up beneath it. He has no means of separating the currents in the front chamber. Mr. Miller, in one of his boilers, uses tubes similarly arranged, but places a circulating tube inside each, which

receives water from a separate division in the front chamber, formed by a diaphragm, into which the circulating tubes are screwed, and which extends nearly to the water level. The Martin form of boiler is probably the best that has yet been devised. The water tube system seems to give the best results. The most recent form of boiler is that in which the chamber of the water level is through a tube coming from the inside to the diaphragm, it is much the same as the Field boiler, with some modifications.

Mr. John B. Root remarked that if circulation is to be carried out to its legitimate results, we should obtain some satisfactory theory or data from which the requisite degree and direction of the circulation, the size of water channels, &c., can be computed. The circulation should be sufficient to prevent a steam bubble from forming on the surface of the water. The size of the tube should be large enough to carry a volume of water that would contain all the heat. His theory was that the circulation should be in all cases from the heating surfaces of the boiler to or near to the water line, and back to the heating surface; that the water line should be far enough above the heating surface to enable the amount of circulation to prevent entirely the formation of steam bubbles upon the heating surface. The water in contact with the heating surface being under a greater pressure than that at the water line, owing to the head of water above it, will take a correspondingly greater temperature, and will begin to part with its excess of heat, by forming steam, when it reaches that point in the ascending circulating column where its temperature corresponds with the pressure; the steam being formed throughout the body of the water in suspension. If the steam be formed upon the heating surface, the sediment will be there deposited, and the efficiency of the surface diminished by the steam bubbles interposing between the heating surface and the water. Now supposing the steam to be formed, about two feet below the water line, the temperature at that point should be one degree higher than at the water line, and the pressure one pound greater. Consequently, the amount of water circulated over the heating surface in a given time should be sufficient, when heated one degree, to contain all latent heat of the steam taken from the boiler in the same time. For instance, should the boiler be working under sixty-four pounds pressure, temperature at water line 300°, the latent heat of steam would be 912°, the total heat contained in the steam 1,212°, evaporation of water being one pound per minute. The circulation necessary to convey the heat

from the heating surfaces would be 1×912, or ·912 pounds of water per minute. The steam generator invented by the speaker, is composed of inclined tubes suitably arranged over the furnace. The water circulates up through the lower tubes, parts with its steam at the upper ends of the tubes, and returns to the lower ends of the lower tubes again by the tubes which have their upper ends at or near the water line. The connections between the tubes at their ends form chambers with contractive openings or communications, which serve to prevent the violence of the circulation from projecting the water into the steam room and causing the boiler to prime or work water. The amount of circulation varies with the inclination at which the tubes are set. The amount of water that the opening at the end of any tube will pass when set at the proper inclination is fully twenty-six cubic feet per minute, which is sufficient for all practical purposes; but the amount of circulation can be increased to three times that amount by adding extra connections at the ends of the tubes, which does not require any change as to the principle or form of the connection. A boiler should be so constructed that a steam bubble should not be formed lower than two feet from the top of the water. He had never seen it stated what the amount of water circulation should be for every pound of pressure. The small amount of water that is over the crown sheet of the Martin boiler would seem to be too much heat for too little water. Boilers scale where the heat is greatest, and the circulation rapid. When water rises to a certain temperature, it crystallizes and leaves a scale.

Mr. John A. Coleman said he had listened to the discussion on the circulation of water in steam-boilers, and the whole subject seems to be involved in a mystery. Let us now view the matter in another light. The first problem in steam engineering is to produce heat, the next to make the water absorb it. A square foot of iron will transmit a given quantity of caloric, two square feet twice as much, and so on. When we shovel coal on a grate it is to get heat, and that object is rarely well done. We put coal on a grate and combustion ensues, and the gases pass off very rapidly. If the draft is very strong much combustible matter is carried up the chimney before it can be mixed with the requisite amount of oxygen, without which there cannot be perfect combustion. The bottom of a pot over the fire may be considered the best form of heating surface; the old cylinder-boiler is the same in principle, and in sufficient numbers will make steam as well as any other kind of boiler in existence.

The cylinder-boiler, however, requires so much space in order to provide heating surface in so simple a form, and is so expensive and dangerous, that we must look for some other construction of steam generators for general use. In order to reduce the size of the boiler with the same heating surface, we, so to speak, double it up by putting in flues. This introduces the drawback of unequal expansion and contraction ; a most fruitful source of mischief. To make the boiler still smaller without reducing the heating surface, we double it up again by changing the flues to tubes, which increases the objection just mentioned ; and in practice, foot for foot, the heating surface is not as efficient as that of the old plain cylinder. A perfect boiler would combine the heating surface of a cylinder-boiler with water held in small quantities in extremely strong receptacles. Cylinder-boilers are not commonly made in the best manner. Any rupture at high pressure allows the great volume of water to flash into steam with a corresponding force of explosion. In most safety boilers, made up of tubes and with thin volumes of water, there is too much heat for the quantity of water when the boiler is forced to its work in actual service, and the rapid evolution of steam drives the water out of contact with the heating surface. This is obviated in the Harrison sectional boiler, by using spheres, which have twice the strength of cylinders, which contain water enough to keep it in contact with the heating surface, and which allow circulation crosswise as well as longitudinally of the ranges of spheres. These are so united that before a pressure is reached sufficient to burst the spheres, the connecting-rods will stretch, so that each joint constitutes a safety-valve, and thus avoids the results of a sudden escape of a large quantity of highly heated water. The plain cylinder boiler explosions are the most terrific known in this or any other country. The different parts of the boiler are heated unequally, so that it has been said that if a boiler of this kind was made of silk, it would be found to be puckered up in many places. Another defect in many boilers is the rivets are improperly fitted; if the holes in the plates are not in line, a toper punch is driven in the hole and made to crowd in line. Large boilers are unsafe. The best method of circulation in boilers is to hold small quantities of water in small receptacles, and should any of these be shattered, no serious results can be apprehended. Mr. Harrison claims that as far as a boiler can be made perfect he has done so; and, in regard to the matter of circulation, his boiler has as much as is required. A good engineer and fireman are all important requisites

for an engine room. Manufacturers, in endeavoring to economize on first cost, often ruin themselves. In many instances he had seen fires heaped upon grates eighteen inches thick.

Mr. C. E. Emery stated that the Committee on Manufactures and Machinery of the American Institute, at their last meeting, re-elected their present Chairman, Professor Tillman, who had served them so well; and Mr. Robert Wier, a gentleman who is known for his scientific attainments, was appointed Secretary of the Polytechnic Association for the coming year.

The Chairman said he was very grateful to the Committee for thus again honoring him, and while accepting this mark of their esteem, he expressed the hope that at the end of the year, he would be allowed to retire. He had held the present position more than seven years. During this long period he had endeavored to discharge, impartially, the duties of his office. Doubtless he had made mistakes, but his chief aim had been to give every one an opportunity to set forth his own opinions, so long as they were in accordance with the well-settled laws of science. New inventions always have the first claim to attention in our Association, and he was gratified to know that inventors had generally expressed satisfaction at the criticisms here passed upon their new devices. His reports on scientific progress had often furnished topics for interesting discussions; but he regarded this order of business as subordinate to that of giving greater notoriety to those meritorious American inventions, which are first submitted to this Association for examination.

The business of the evening was concluded by an examination of a drawing, made by Mr. Partridge, of a mirage, seen by him on the morning of February 21st, 1870, while crossing New York bay.

Adjourned.

March 17, 1870.

Professor S. D. Tillman in the chair; Robert Weir, Esq., Secretary.

Shampooning Apparatus.

Mr. M. L. Winn exhibited his shampooning apparatus. It is constructed of a rim or bottomless pan, with a gutta percha lining so devised and provided with an elastic strap as to fit tightly around the head below the principal part of the hair. The drapery or curtain, which falls below the rim, is both for ornament and use. The

gutter is strapped tightly about the neck, at the extreme lower part of the hair, catches any water that may escape from the apparatus. A flexible tube is appended, by which the water may be carried off to the sink, so that the person will have no occasion to leave the seat during the entire operation of shampooning, or even remove his neck-tie. The flexible rim which adjusts the appaartus to the head makes this device perfectly practical. The price of the machine is twenty dollars. Those who had submitted to the cleansing operation of this apparatus had expressed themselves pleased with the manner in which the work was done.

Planeometer.

Mr. C. D. Anderson exhibited and explained Amsler's planeometer, for calculating the area of irregular figures, designed for engineers generally, and used much for measuring the area of indicator diagrams of steam engines. One arm of the instrument, which has a graduated scale, is moved along the outline of the diagram, and the area is multiplied by a constant. The diagram records the revolutions of the wheel. The instrument gives more accurate results than can be arrived at by human calculation. It is small enough to be carried in the pocket, and can be purchased in Europe for less than 100 francs. For a complete description of the theory and practical operation of the planeometer, the reader is referred to the voluminous and valuable reports recently made by F. A. P. Barnard, LL. D., United States Commissioner to the Paris International Exposition.

Mr. C. E. Emery said that by this instrument there is no guessing as with the usual method. Mr. Emery here made on the blackboard diagrams of indicator cards, and showed the advantages of this instrument over mental calculation.

Rotary Dynamometer.

Mr. Charles Neer exhibited his dynamometer. The instrument shows the true amount of power used by any machinery to which it is attached, or the capacity of any engine, water-wheel or other motor, and can be easily moved from shaft to shaft to determine separate parts. It has been applied to machinery in operation at the exhibitions of the American Institute, and has met with very general approval.

The Association resumed the very interesting discussion which had already occupied a part of several evenings, on

Steam Boilers.

Mr. John A. Coleman said that we are apt to get on side issues before we have got a plan. The steam boiler is a very important article, and its form and management has always excited much discussion. In presenting the subject we should commence at the top and go to the bottom. He would therefore take the top of the grate bars as his first point. What takes place when coal is shoveled on the top of the grate? The first thing is the separating of the carbon from the hydrogen of the coal, and this cannot be done unless the coal is given a sufficient amount of oxygen, and generally when the resulting gases are evolved from the coal, they have to ascend some forty feet through the chimney. And, even if the proper amount of oxygen is supplied, there is not sufficient time given for the proper evolution of the heat. We must have a large combustion chamber. In other words, slow combustion is the economical way to use coal. It is not always practical to make heat by the various plans attempted. There are many ways of making a furnace. A boiler with a water leg is, on principle, defective. Boilers for marine purposes involve a different set of principles from those on land. Therefore, that boiler should be left to itself. The gases, when evolved from the coal, are very attenuated, and they go along unmixed with the coal; and chemists may take these gases and find dollars in them. If molasses is poured on water, it will be difficult to get the two united, but if a little molasses and water is first mixed and then put into water the union will be made much quicker. Now, a steam-boiler is nothing but a large kettle to boil water, and we want to know the best way to get the heat to the water in that boiler. A square foot of iron will take so much time to heat it. The bottom of a pot is the best form of boiler, and the nearer we approach to that will be the best. The plain cylinder-boiler is as good a form of boiler as can be made. A plain cylinder-boiler in a cotton mill will furnish a yard of cotton cloth just as cheap as the best tubular boiler. But they are not generally used because they are exceedingly dangerous; and being made long, contain in most instances, lukewarm water in some parts. The results with the flue-boilers are no better than with the cylinder. These two boilers have their peculiar disadvantages. A cubic foot of water thoroughly charged with heat becomes 1,700 cubic feet of steam in an instant; and so, whenever there is a rupture, there is the greatest scattering of the adjacent parts. There is another objection to them, and that is, it is impossible to make them

strong. Fairbairn in his experiments shows that a sheet of iron has only fifty-six per cent of its original strength after riveting. There have been various devices to make boilers safe, but the best plan is to make them so that when there is a rupture but a small part of the steam can be scattered around. The Harrison boiler fully answers this requirement, and during the six years they have been in general use, they have proved very efficient and safe. The Harrison sectional boiler is made of cast iron, which is theoretically but half the strength of wrought iron. But we argue that an inferior material made in a superior shape is as strong as a superior in a bad shape. It is known that cast iron is very brittle, and that it gives way suddenly; this is an important fact and a fortunate one, as it gives warning of a rupture, and but a small part is injured; but the wrought iron boiler gives no warning, and when it does explode it does so with terrific fury. The circulation in the Harrison boiler is free, but a little circuitous, it is as perfect as in an ordinary kettle. It is said that if water is rushed over heated iron very rapidly it will make steam quickly; but there is just one way to make water boil just as it was in the days of Adam. The experiment of using a fan wheel in a boiler to scatter the water about, was a perfect failure. In the Harrison boiler steam can be raised in forty minutes. Mr. Harrison has spent many thousand dollars simply in experimenting, and his experiments on boilers have lasted for twenty years. The series of globes which constitute his boiler are eight inches in diameter, and are very strong. They have been in use for two years without forming any scale, while others scale in six months, using the same water. Out of 56,000 globes in use, we have had but fifteen that have cracked legitimately, and these have all cracked in the neck. This is a fraction of one per cent. So this side of the account does not look bad.

Mr. John B. Root remarked that a boiler deposits its scale invariably at the heated surface; there is a little bubble of steam exploded there, and a small sediment is left. This takes place on a stove the same as in a steam boiler; but when it is done in the latter, the sediment is kept some time in solution, and can be carried off with the steam. But if the bubble of steam can be carried up toward the surface of the water, where the pressure is less, no sediment will be directly deposited. Circulation is of much benefit in relieving the boiler from scale. Steam is a non-conductor, and these bubbles form on the surface of the iron, and obstruct the passage of the heat to the

water. When steam begins to form on the heated surface of the iron, the efficiency of the boiler immediately begins to diminish. The point of circulation in boilers has been much overlooked. Unless steam bubbles can be prevented, circulation is not of much value. The Harrison boiler, in a mechanical and philosophical point of view, is a failure. To use wrought iron and cast iron together is not philosophical, the globes of cast iron in the Harrison boiler, are fastened together with rods of wrought iron. The cast iron must crack or the wrought iron must stretch. Cast iron put together with bolts cannot be durable, as the wrought iron would stretch when heated, and when the rods cooled they would have to be tightened. As to the Harrison boiler taking less room, a boiler made of pipes can be made to occupy half the space of one with globes.

Mr. Coleman stated that wrought iron could not expand, practically, more than the cast iron, when it is in the water, and cannot receive more heat than is in the water; and the cast iron is in the steam, and so the two metals are about at the same temperature. At the Charlestown sugar house, in Massachusetts, one of the Harrison boilers has been in constant use for three years, and subject to an intense heat, but he had never seen the least sign of a leak in it; and this was the case with several of these boilers in other places. A test of an instrument is in its working, and no theory will answer in its stead.

After some further discussion of the subject, the Association adjourned.

March 24, 1870.

Prof. Samuel D. Tillman, in the chair; Robert Weir, Esq., Secretary.

The Chairman opened the proceedings by reading the following notes on science:

The Graphotype.

This ingenius substitute for wood engraving, now used extensively in Europe, is the invention of Mr. De Witt Clinton Hitchcock, an American. The process consists in coating sheet zinc with a surface which can be easily removed, excepting that portion covered by the drawing. Over a smooth zinc plate is thinly spread very fine pure chalk powder, and on this is placed a highly polished steel plate, when the whole is subjected to a pressure of 150 tons. After removing the

steel plate, the perfectly smooth and ivory-like surface of chalk remaining is covered with a wash of strong size, and when dry is ready to receive a line drawing, similar to that made on wood. The drawing is made with sable-hair brushes of different sizes, wet with an ink composed of glue and lampblack with a little glycerin, or of a solution of borax and shellac with lampblack. After the drawing is completed, the surface is submitted to the action of a rotating brush, which removes all the chalk coating not covered by the ink, thus leaving the drawing in relief. To protect this surface, it is coated with a solution of water-glass which hardens it, so that a mould can be taken from it in the ordinary manner, from which the electrotype or stereotype, to be used in printing, is made. In this case, the artist is the author of the engraving, and is sure to find the picture reproduced precisely as he made it. This result is obtained with readiness and at a trifling cost; and for many kinds of illustration, the process is found to have advantages over ordinary wood engraving.

Aluminate of Soda.

This compound, as produced by the Cryolite soda manufacturers, is quite free from iron, and is especially serviceable in making white opaque glass for French glass gas-globes, in dyeing, and in soap-making, where heavy, white soap is required.

Coal Gas not Injurious to Roots.

Dr. Poselger has shown by repeated experiments that the growth of trees and shrubs is not interfered with by any quantity of coal gas that may escape in the soil and find its way to their roots, and consequently that the illuminating gas escaping from mains does not injure the trees growing along the streets and promenades of cities, as many persons had previously supposed.

Temperature of Salt Solutions.

Mr. Spence, of England, has been led by experiment to conclude that the temperature of a solution of any salt is in proportion to its specific gravity. He placed a solution of nitrate of soda (having a boiling point of about 250° Fahrenheit), in a vessel surrounded by a steam jacket; into the latter he admitted steam until the whole jacket was heated to about 212°, steam was then discharged into the solution, when the mercury of a thermometer placed in the solution, slowly and steadily moved upward until it indicated a temperature of 250° Fahrenheit.

Carbolic Collodion.

Dr. J. M. Hirsh, of Chicago, has published in a new journal, The Arts, a description of the method of preparing his new mixture for stopping hemorrhage. Taking advantage of the astringent property in carbolic acid, which even in dilute solution will check the flow of blood, he prevents external coagulation; objectionable on account of its liability to break off and allow the flow to commence anew; by adding to carbolic acid, or phenol, collodion, which almost instantly forms an artificial covering closely fitting the wound, so that coagulation has to take place within or beneath this coating. Ordinary collodion, which is a solution of gun-cotton dissolved in ether, contracts greatly upon the evaporation of the latter, and frequently scales off. To obviate this, he uses glycerin, which has the property of rendering the collodion elastic. He finds that carbolate of glycerin is soluble in all proportions in collodion. The highly irritating and poisonous property of carbolic acid suggests that it should be used very sparingly in this compound.

On this item Mr. J. A. Coleman remarked that several members of his family having the hooping cough, were greatly relieved by breathing the fumes of cresylic acid, a solution of which was put in a saucer and placed in the room where the sick were confined.

The Chairman said cresylic acid in its sanitary effects resembles carbolic or phenic acid.

Preparation of Fiber for Shoddy.

The wool fiber of old rags and carpets, made of a combination of wool with cotton or linen threads, can be separated by the use of metallic chlorides or sulphates, the chloride of aluminum being the most available. To obtain the latter, 100 pounds of sulphate of aluminum is dissolved in 100 gallons of hot water; on adding to this solution fifty pounds of common salt, a chemical change produces sulphate of sodium and chloride of aluminum. After the rags have been saturated with a solution of chloride of aluminum, the excess of liquid is drained off and the material is heated to about 200° Fahrenheit. The chloride of aluminum is decomposed during this process, and the volatile products, acting on the cotton or linen, decompose it, while the animal fiber remains unchanged, and on being rubbed up or carded the vegetable matter is separated in the form of dust. In some cases it is found more effective to first immerse the rags in a strong solution of sulphate of aluminum, and then place

them in a saturated solution of common salt, which is boiled until the decomposing or rotting process is completed.

Diamonds and Quartz.

The Quarterly Journal of Science says: On a question so obscure and enigmatical as that of the origin of the diamond, every tittle of evidence is worth recording. Dr. Göppert, in his famous essay which gained a prize at the Haarlem Academy in 1864, argued strongly in favor of the formation of this mineral by the wet way. He now publishes an account of certain diamonds containing organic structures tending to confirm his views. Two diamonds in the Royal Mineralogical Museum in Berlin were found to inclose numerous green cells, closely resembling those of many algæ. One of the diamonds, weighing 263 milligrammes, contains a very large number of perfectly round green granules, which appear to be isolated cells not unlike those of *Protuccus pluvialis.* The new species is accordingly named *P. adamantinus.* In the second diamond, weighing 345 milligrammes, the cells are less rounded and more elongated in form, while they frequently unite so as to form a loose parenchymatous tissue; they find their best representatives in *Palmoglea macrococca*, and Göppert has accordingly ventured to name the new diamond plant *Palmagloeites adamantinus.*

Once again the old mistake has been repeated in Australia. In the northeast district, a stone was found, about the size and shape of a duck's egg, and weighing 6 oz. 13 pwts. 12 grs., Troy. Of course it was taken for a diamond, and rumor was soon rife as to its prodigious worth. A few days after announcing the discovery, The Australian Mail coolly adds: "The great diamond which had created so much sensation has proved to be a piece of crystal-quartz."

Spectrum analysis has been applied by Vogelsang and Geissler to the difficult question of determining the chemical nature of the fluid found inclosed, in minute quantity, in the cavities of certain quartz-crystals. Fragments of quartz were placed in a small retort, which was connected with an air pump and exhausted; then, by the application of heat, the quartz decripitated, and the evolved vapor was examined in a Geissler-tube. The presence of carbonic acid was thus abundantly proved, and this was confirmed by the turbidity which it produced in lime-water.

Spontaneous Motion of Protoplasm.

Prof. J. B. Schnetzler, in his observations on the spontaneous motion of the protoplasm in the cells of the leaves of the common water-weed, *Anacharis alsinastrum*, recently published, expresses the opinion that the principal cause which provokes the motion is the chemical action of oxygen, which passes through the wall of the cell, and of which a portion is probably transformed into ozone under the influence of light, as occurs also in the globules. The currents thus produced are influenced by the highest refracted rays of light, and also, probably, by electricity formed under the influence of water between the surface of the leaf and the contents of the cells.

Vegetable Parasites.

In a paper read before the Illinois State Microscopical Society, Dr. N. S. Davis says: "It is a fact worthy of note that, up to the present time, vegetable parasites have been found only in connection with diseases of such structures as are covered with epithelial cells, like the skin and mucous membrane, or on suppurated surfaces, where the organic cells are undergoing more or less degeneration. This legitimately suggests the question whether all these parisitic forms of matter are not the result of what Erasmus Wilson has styled *phytiform*, degeneration of cells and granules of animal matter? But aside from all such questions of a histological character, the study of parisitic growths in connection with the prevalence of diseases, especially of an epidemic character, is of the highest importance in its bearing on sanitary regulations, and the health of communities. In this direction, some things of great importance may be considered as already settled. Whatever may be the differences of opinion among observers in relation to the nature and mode of development of these simple parisitic bodies, found in connection with epidemic and some endemic diseases, all agree that their production and rapid multiplication are directly dependent on the coexistence of three things, viz.: Organic matter capable of undergoing degeneration or decay, moisture, and a temperature generally above 60° Fahrenheit. If, with these, we have coincidently the exclusion of sunlight, we have the condition most favorable to all vegetable parasitic formations. If the co-operation of these causes will generate a cholera fungus in the valley of the Ganges, we see no reason why they will not do the same in the valley of the Mississippi, or in Chicago. But whether the cholera fungus is generated here or

imported from the other hemisphere, it is certain that, without the co-operation of the three first named conditions, neither it nor any other fungus can be propagated, to the injury of individual or public health. Hence, whatever contributes to the prompt removal, from this or any other city, of the decomposable organic matter, the surplus water or moisture, and gives to all its inhabitants air and sunlight, contributes directly to the public health.

Improved Furnace.

Mr. Jonathan Amory, of Boston, exhibited a model of a furnace. He said it had been extensively applied in the smelting of ores in California, Nevada, Montana, etc. Fairbairn and other engineers of equal reputation, have given certificates of a saving of thirty-seven per cent over the best results before attained. A slow combustion is kept up in one chamber, from which the carbonic oxyd is taken to another chamber, where, between reverberating plates, it meets with currents of hot air, when it is at once converted to carbonic acid, generating at the same time an intense heat. This is the chamber of quick combustion; from here the highly heated gases are conducted along the surfaces that are to absorb the heat. By this means all the combustible gases are burned, and none are left to take fire at the top of the chimney. In steamers the air may be taken from the deck, and the furnaces so arranged that the fires may burn well when the water was up to the grate bars; a great advantage in case of springing a leak at sea. These furnaces are also in use on some eight lecomotives. A church holding twelve hundred persons had been warmed by only two of these furnaces.

Mr. Robert Weir asked if the great heat would not burn out the curves or iron bridges.

Mr. Amory replied that he did not find it so; he makes the curves so that they will last as long as the boiler. Thirteen years ago he applied this furnace to some eight locomotives, and by it we were the first to use our coal on locomotives in this country.

Improved Steam-boiler.

Mr. McGinnis showed a model of his vertical boiler. He proposed to use a number of them on board of steamships, and carry steam of very high pressure.

Mr. J. B. Root said that the more this boiler approached to the

sectional shape the better. There are some ideas in it which are of some value and should be looked into.

Mr. C. E. Emery remarked that a boiler somewhat like this has been working for some time in Center street in this city.

Mr. J. K. Fisher said he was told by locomotive engineers, that steam of 120 pounds pressure is injurious, as it cuts the valve seats, and cylinder bore. He wished to get at the fact. Does any one know of the cutting of valve seats by high pressure steam? He also wished to know if smoke was not drawn into the cylinder when there was a strong vacuum produced. The smoke and not the high pressure may be the cause of the cutting. It has been said that locomotives going down a grade with the steam shut off, the cylinders would "howl" as it is termed; but when the steam is on this noise was not heard.

Mr. James Montgomery stated that he had known as high a pressure as 400 pounds to the square inch being used on the Mississippi steamers. There were other steamers on which the pressure in the boiler could not be known, as there were pigs of lead hung on the safety valve lever. He had been on boats that had steam of 500 pounds in the boiler and with a forty-eight inch cylinder. Fairbairn found that the cylinder part of a locomotive boiler will stand a pressure of 800 pounds of cold pressure; and a certain form of the upright boiler some 1,400 pounds. The question of high and low pressure is one of much importance, especially at this time. A certain quantity of coal will do as much work as a far greater amount, if the pressure is sufficiently high. In the English boilers the steam pressure is about an atmosphere and a half. Steam at 700 pounds pressure would be red hot. The boilers of ocean steamers should always be placed on deck, like those on the Mississippi steamers, so that in case of springing a leak the fires in the boilers would not be put out first.

Mr. Amory said the captain of the ill-fated steamer San Francisco told him that the ship was lost on account of the large quantity of coal she carried above the water-line, which made her unsteady.

Mr. J. B. Root remarked that he had never seen any gain in using steam over 120 pounds. When we get to 150 pounds there is considerable difficulty in keeping the machinery in order, and this overcomes any extra pressure which is obtained. He saw no way to obtain the miraculous results claimed for high pressure. Over 120 pounds there is no gain. Steam can be worked at 300 pounds pres-

sure, but not with a slide valve; a balanced puppet valve must be used. There is no difficulty in making an engine work at that pressure; but he believed that from ten to twelve pounds of coal per horse-power would be used.

Mr. Charles E. Emery said that about two years ago he had occasion to test this question of expansion. In his experiments he found that the greatest loss in the steam engine is the back pressure. There are fifteen pounds of air pressure to be overcome, and, if sixteen pounds of steam are used, we have but one pound to work over the atmosphere. He had prepared a little table, which he found was carried out in practice. There is little difficulty in determining the steam pressures which will practically furnish the power most economically in a non-condensing steam engine. In all engines about nine-tenths of the heat passes away with the exhaust steam; but, in addition to this great loss, there are others, among which is chiefly the loss of power required to displace the back pressure. In non-condensing steam engines the back pressure is in round numbers fifteen pounds above that of the atmosphere, or thirty pounds total pressure; one-half of the total power is required to overcome the back pressure, and one-half only is utilized. By multiplying these illustrations we are likely to jump at the conclusion that the higher the steam pressure the greater the economy, for the reason that the back pressure becomes comparatively of less value. The table spoken of is strictly correct only in reference to engines using steam without expansion. When the steam is used expansively, the result, so far as the back pressure alone is concerned, is less favorable to the high pressure than is shown; but, in such case, some economy is produced by the expansion, which must be separately considered.

Table *showing Proportion of power lost to overcome the Back Pressure in Non-condensing Engines, working with the different steam pressures named.*

Steam above atmosphere.	Pressures above zero.	Loss due to back pressure.	
		Proportion.	Percentage.
0	15	Whole.	100.0
15	30	1-2	50.0
30	45	1-3	33.3
45	60	1-4	25.0
60	75	1-5	20.0
75	90	1-6	16.6
90	105	1-7	14.3
105	120	1-8	12.5
120	135	1-9	11.1
135	150	1-10	10.0
150	165	1-11	9.1
165	180	1-12	8.3
180	195	1-13	7.7
195	210	1-14	7.2
210	225	1-15	6.7
225	240	1-16	6.2
240	255	1-17	5.9
255	270	1-18	5.6
270	285	1-19	5.3
285	300	1-20	5.0
300	315	1-21	4.8

The above table explains itself, and shows at once that the savings due to an increase of steam pressure are important up to, say ninety or 100 pounds. Above that point, however, they are too small, in his opinion, to overcome the well known disadvantages due to high steam. There is a saving only of seven per cent by increasing the pressure from ninety to 195 pounds, which will hardly equal the losses due to increased leakages, radiation, strain on the boiler, etc., to say nothing of the popular feeling of greater danger. By still further raising the pressure to 300 pounds, the increased saving would be only 2.4 per cent. On the contrary, it will be seen that carrying less than eighty pounds steam pressure in a non-condensing engine, as is too much the practice about this city, is simply throwing away fuel. By careful experiment he found that the best practical results are obtained with pressures varying between eighty and 100 pounds, and he considered that higher pressures are of advantage only where light weight is of paramount importance.

Some members wished Mr. Emery to explain what results would be due to very high steam used expansively; but the hour of closing having arrived, the Chairman requested the speaker to continue the subject at the next meeting.

Adjourned.

March 31, 1870.

Professor S. D. Tillman in the chair; Robert Weir, Esq., Secretary.

The Chairman opened the proceedings by reading the following notes on science and its application to the useful arts:

Observatory on Mount Ararat.

The Paris Cosmos says that the Russian government has resolved to establish an astronomical and meteorological observatory on this mountain, situated near Tiflis, in consequence of the excellent report given by Dr. Piazzi Smith of the fitness of such high situations, derived from his experience on the Peak of Teneriffe.

Platinum Light.

M. Schinz states, in the Cosmos, that his experiments prove that platinum brought to a white heat by means of the ignition of a mixture of hydrogen and carbonic oxyd gases yields a light which, in relation to the illuminating power of that of good coal gas, is as 1.24 to one.

Gases in Arable Soil.

M. Herve Mangon, writing on this subject in the Cosmos, states that, akin to most porous substances, arable soil has the property of condensing gases. He found that the quantity of gases thus condensed varies in bulk (for the same quantity of soil) from two to ten volumes of gas.

Colors of Gases in Geissler Tubes Changed by Magnetism.

M. Treve, in a recent communication to the French Academy of Sciences, gives an account of his experiments with gases inclosed in glass tubes and exposed to a current of electricity, and at the same time to the influence of a powerful electro-magnet. Having taken a Geissler tube filled with hydrogen, one portion of the tube being drawn out to capillary thinness, he caused the induction current to pass through

it, which, as is well known, imparts to the gas in the thick part a blue color, tinged with violet, and in the capillary portion a brilliant red. Now, if the latter be placed between the poles of the electro-magnet, the red at once disappears, and is converted into white light. In the case of oxygen, the capillary part is milky white; under the influence of electro-magnetism it becomes red. Under the same circumstances the blue of nitrogen becomes much darker, and the sparkling white of carbonic acid turns blue. Hence, so far, magnetism is found to destroy or change the color of a gas in the capillary part of a tube containing it.

Another Large Telescope.

Messrs. Cooke & Son, of York, Eng., have just completed a telescope thirty-two feet long, having an object glass tweny-five inches in diameter. No report has reached us regarding its power and quality. It was made for Mr. Newall, submarine cable manufacturer, of Gateshead, who intends to erect an observatory for its accommodation at Madeira.

Water-proof Packing Paper.

This paper is prepared by coating it with a resinous liquid, and afterward painting it with a solution of glue and soot, to prevent the appearance of blotches. After it is dry the true water-proof coating is applied, which consists of a solution prepared with two and a half ounces of powdered shellack to two pints of water; to this, while hot, is added gradually one-third of an ounce of pulverized borax; at the same time, mineral coloring matter, like ochre or umber, may be added. When cold it is ready for use. The operation of coating is so quickly performed that two persons may prepare 3,000 square feet of paper per day.

Spectrum of the Fire-fly.

Mr. C. A. Young has described in the American Naturalist the spectrum given by the common fire-fly as being perfectly continuous, without trace of lines, either bright or dark, and extending from a little above Fraunhofer's line C in the scarlet to about F in the blue, gradually fading out at the extremities. It will be observed that this portion of the spectrum contains the most luminous rays, the calorific and actinic rays not being brought materially into play. This insect, therefore, has the power of generating only those undulations whose velocities are such as to affect most powerfully the organ

of vision, and in this respect is a remarkable adaptation of force to precisely the object to be attained. In all devices for illumination by artificial means, many waves, moving both slower and faster than those required, are simultaneously generated, so that but a small portion of the radiant energy exerted is made available to human vision. Yet it may be doubted whether any strong and serviceable light can be produced without a simultaneous generation of the whole range of undulations from the slowest to the most rapid, as found in solar rays.

Reversion Spectroscope.

Dr. J. C. F. Zöllner, of Leipsic, has explained before the Royal Society of Saxony his new form of spectroscope, by which spectra are reversed. In his arrangement the line of light produced by a slit, or cylindrical lens, lies in the focus of a lens, which in all spectroscopes renders parallel the rays to be dispersed. Then the rays pass through two direct-vision prism-systems, so fastened to one another that each passes one-half of the pencil of rays proceeding from the collimator object-glass, and, also, so that the refracting angles lie on opposite sides. In this way the collected pencil of rays will be dispersed in the two spectra in an opposite direction. The object-glass of the observing telescope, which unites the rays again to an image, is perpendicular to the refracting angles of the prisms placed horizontally, and, as in the heliometer, is divided; each of the two halves can be moved micrometrically both parallel to the line of section and perpendicular to it. By means of this the lines of one spectrum can be brought into coincidence with those of the other, and the spectra can be placed in immediate juxtaposition, instead of being superposed, so that one spectrum moves by the other like a vernier, or the spectra may be superposed only partially. In this construction not only is the delicate principle of double images rendered available for the determination of any change whatever in the position of the lines of the spectrum, but any such change is doubled, since its influence appears in the two spectra in an opposite sense. To use the instrument without the system of prisms it is only necessary to reverse one part of the pencil of rays proceeding from a common prism by reflection on a mirror or prism, and then to observe the united pencil of rays exactly as before described with a telescope furnished with a divided object-glass. The simultaneous introduction of artificial sources of light for the investigation of

small changes of refrangibility are not required, since in this instrument these changes may be measured by the changes in the position of objects completely similar in kind.

The Continuity of the Gaseous and Liquid States of Matter.

In a paper on this subject, read before the Royal Society of London, Dr. Thomas Andrews gives an account of various experiments made by him, during a series of years, upon gases, especially describing the combined effects of heat and pressure upon carbonic acid gas at temperatures varying from thirteen degrees Centigrade to forty-eight degrees Centigrade, and at pressures ranging from forty-eight to 109 atmospheres. The temperature at which this gas ceases to liquify by pressure he finds to be 30.92 degrees Centigrade, or eighty-eight degrees Fahrenheit, and this he calls the critical point. Although liquefaction does not occur at temperatures a little above this point, a very great change of density is produced by slight alterations of pressure, and the flickering movements are conspicuous which render fainter the surface of demarcation between the liquids and gas. As the direct result of his experiments, he concludes that the gaseous and liquid states are only widely separated forms of the same condition of matter, and may be made to pass into one another by a series of gradation so gentle that the passage shall nowhere present any interruption or breach of continuity. From carbonic acid as a perfect gas to carbonic acid as a perfect liquid the transition may be accomplished by a continuous process, and the gas and liquid are only distant stages of a long series of continuous changes. Under certain conditions of temperature and pressure, carbonic acid finds itself, it is true, in a state of instability, and suddenly passes, without change of pressure or temperature, but with the evolution of heat, to the condition which, by the continuous process, can only be reached by a long and circuitous route. The author discusses the question as to what is the condition or state of carbonic acid when it passes at temperatures above thirty-one degrees Centigrade from the ordinary gaseous state down to the volume of the liquid, without giving evidence during the process of the occurence of liquefaction, and arrives at the conclusion that the answer to this question is to be found in the intimate relations which subsist between the gaseous and liquid states of matter. In the abrupt change which occurs when the gases are compressed to a certain volume at temperatures below the critical point, molecular forces are brought into play which pro-

duce a sudden change of volumė; and during this process it is easy to distinguish, by optical characters, the carbonic acid which has collapsed from that which has not changed its volume. But when the same change is effected by the continuous process, the carbonic acid passes through conditions which lie between the ordinary gaseous and liquid states, and which we have no valid grounds for referring to the one rather than to the other. Nitrous oxyd, hydrochloric acid, ammonia, sulphuric ether, sulphide of carbon, all exhibited critical points when exposed under pressure to the required temperatures. The author proposes for the present arbitrary distinction between va ors and gases, to confine the term vapor to gaseous bodies at temperatures below their critical points, and which, therefore, can be liquefied by pressure, so that gas and liquid may exist in the same vessel in the presence of one another.

New Rotary Dynamometer.

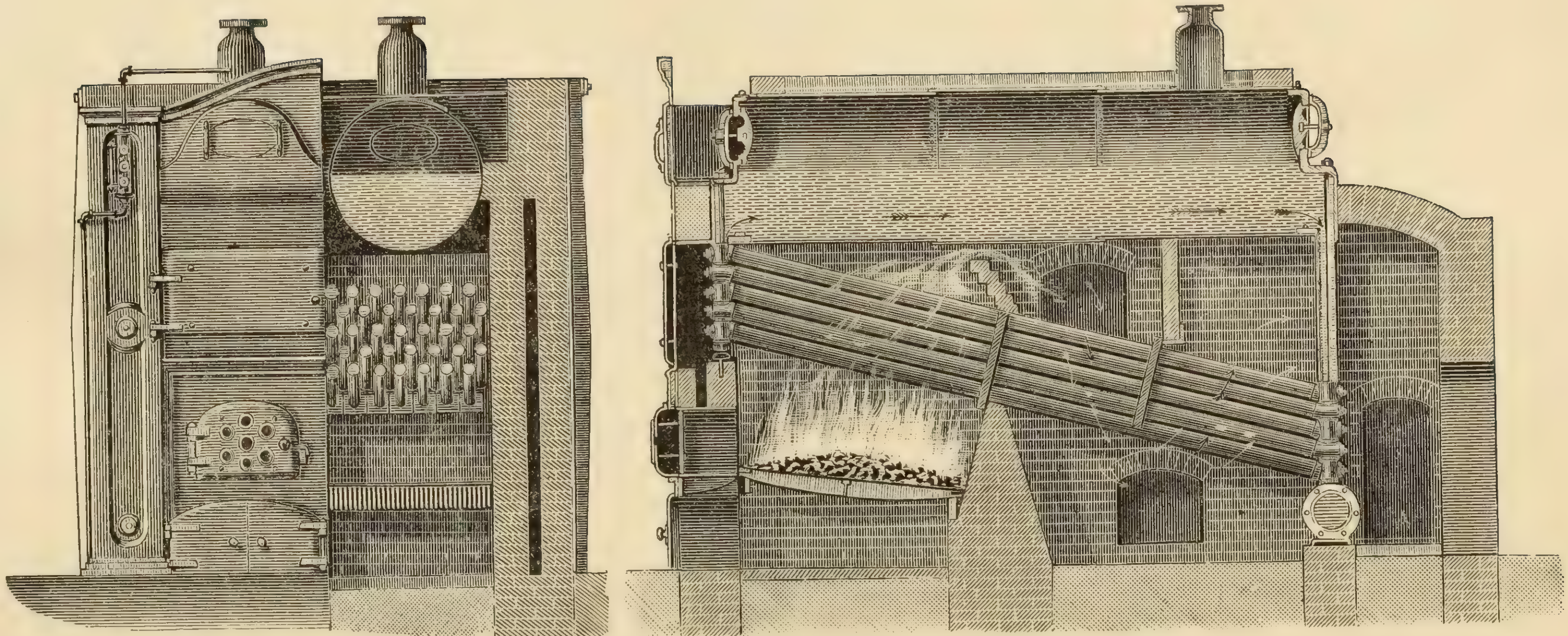
Mr. John W. Sutton, of Oregon, presented a new dynamometer. It consists of two discs connected by springs. One of these discs is fastened upon the shaft, the other is made fast to the pulley which takes the driving belt; this pulley is loose upon the shaft and transmits the power through the connecting springs. A graduated scale with an ndex marks the number of foot-pounds, or, where the number of revolutions is known, the number of horse-power. Means are also provided for automatically recording the amount of work done, much the same as in the indicator diagram. This instrument could be applied to shafting of almost any size, and is capable of measuring up to about fourteen horse-power. It can be adjusted, and set at. zero at any time, should the springs vary. Where it is desirable to test the value of lubricating oils, part of the springs can be removed, by which the instrument is made very delicate. The instrument here shown had been running for six weeks at the fair in San Francisco, and had also been at other places.

Dr. Vanderweyde said that this instrument appeared to be better than any we have here, and is deserving of much more general use. An article of this kind is wanted very much. Here in New York, steam power is rented out, and a person using a saw which, he says, will require so much horse-power, but the owner of the engine finds that he burns much more coal than would be required according to the estimate of the owner of the saw. Horse-power costs, in the very best engines, two and a half pounds of coal per hour; so if in

renting power, a man took more than he paid for, it was easy to see what a loss followed. The average engines would use four and a half pounds of coal per hour, and it was of great importance that every man should know how much power was used, for if more was taken, more coal must go into the furnaces. The rules for calculating the power of steam engines are incorrect, as many mistakes are made by the old method of calculation. The exact pressure can only be determined by the indicator; rules cannot be given. The boiler pressure cannot always be the standard of calculation, for there is a great difference in the pressure in the boiler and that in the cylinder. Therefore, we must take, as the basis of our calculation, the pressure in the cylinder while the piston is moving, and this is shown by the indicator. Then we get the actual amount of the power of the engine. He spoke of this because there was a general misunderstanding on this matter of measuring the power of the steam engine. Duncan, in England, introduced the heat of the condensing water as an element in the calculating of engine performance, and proves those engines leaving the water at the lowest temperature to be the most economical, since there was the least heat wasted. The expansion of steam in the cylinder with the cut-off will reduce the temperature.

Mr. James Montgomery stated, that since the first steamship, "The Savannah," built in New York, crossed the Atlantic in 1819, we have been working by the rule-of-thumb. There is a great deal of ignorance as to who builds the best engines. What we want to know is how much steam is used, and how much power developed. Also, what engine wastes the most power in friction. In renting power, sometimes an inch of belt is reckoned a horse-power, and yet he knew a man who with an inch and a half of belt managed to get some fifteen horse power, and paying for only one and a half. If the dynamometer is used in connection with the indicator, a complete revolution will be made in testing the power and economy of the steam engine. The want of a thorough test like this is much felt in our merchant marine. The indicator only tells us how much steam each engine uses, but the dynamometer shows just how much power the steam produces, and so indicates who builds the best engines.

Mr. Sutton stated that the indicator placed on the engine at the Mechanics' fair in San Francisco, gave some very strange diagrams. He was asked what was the matter, but could not tell at first, but if they would put his dynamometer on he could tell them what the



BABCOCK & WILCOX'S TUBULOUS BOILER.

trouble was. After much overhauling it was found that the indicator was not properly attached. There are few of our master mechanics who could take an indicator diagram properly. The indicator will give the measure of the steam but not the power of the engine.

Mr. Wilcox read the following paper on

BABCOCK AND WILCOX'S TUBULOUS BOILER.

Mr. Stephen Wilcox drew upon the blackboard a design of the steam tubulous boiler invented by Messrs. Babcock and Wilcox—an engraving of which is given on the opposite page—and read the following paper, setting forth its advantages :

This boiler is believed to combine those correct principles of construction and operation which science and engineering experience have established as essential to the highest efficiency, economy and safety. It is neither a radical departure from established practice nor a mere variation of form for the sake of novelty, but has been designed with strict regard to the following requirements of a *perfect steam boiler :*

1st. It should be simple in construction, and be made of the best materials sanctioned by use.

2d. It should have a constant and thorough circulation of water throughout the boiler, so as to maintain all parts at one temperature.

3d. It should be provided with a mud-drum to receive all impurities deposited from the water, in a place removed from the action of the fire.

4th. It should be provided with a combustion chamber so arranged that the combustion of the gases commenced in the furnace, may be completed before their escape to the chimney.

5th. The heating surface should be arranged as nearly as possible at right angles to the current of heated gases, and so break up the currents as to extract the entire available heat therefrom.

6th. The boiler should have sufficient water surface for the disengagement of the steam from the water, in order to prevent foaming.

7th. It should have a steam and water capacity of not less than two cubic feet per horse-power, to prevent sudden fluctuation in pressure or water level.

8th. It should have a great excess of strength over any required strain, and should be so constructed as not to be liable to be strained by unequal expansion.

9th. The water space should be divided into sections, so that when

any part gives out there is no large single body of water to flash into steam and thus cause the destructive effects so common to steam boiler explosions.

10th. All parts should be readily accessible for cleaning and repairs.

This boiler is composed of lap-welded wrought iron tubes, placed in an inclined position and connected by T heads with each other, and a horizontal steam and water drum, the T heads forming vertical passages at each end, while a mud-drum connects the tubes at the lower end. The tubes are "staggered" (or so placed that one row comes over the spaces of the previous row), and the whole are held together by a series of strong bolts. The fire is made under the higher end of the tubes, and the products of combustion pass up between the tubes into a combustion chamber under the steam and water drum; from thence they pass down across the tubes, then once more up through the spaces between the tubes, and off to the chimney. The water is fed in at one end of the mud-drum and blown out at the other; and the steam is taken out at the top of the steam drum, near the back end of the boiler.

Circulation of Water.

The water being inside the tubes, as it is heated tends to rise toward the higher end, and as it is converted into steam—the mingled column of steam and water being of less specific gravity than the solid water at the back end of the boiler—rises through the vertical passages into the drum above the tubes, where the steam separates from the water and the latter flows back to the rear and down again through the tubes, in a continuous circulation. As the passages are all large and free this circulation is very rapid, and produces three very important advantages:

1st. It sweeps away each particle of steam as fast as formed, and supplies its place with a particle of water, thereby absorbing the heat of the fire to the best advantage.

2d. It causes a thorough commingling of the water throughout the boiler, and a consequent equal temperature, thus preventing those very serious strains from unequal expansion, which occur in all boilers of ordinary constructions, and which are a frequent cause of explosions.

3d. The rapid circulation prevents, to a great degree, the formation of deposits or incrustations upon the heating surfaces, sweeping them

away and depositing them in the mud-drum, whence they are blown out.

Economy of Fuel.

This results from perfect combustion and thorough absorption of the heat. The products of combustion pass readily through the wide interstices between the tubes into the combustion chamber, where they mingle and complete the combustion commenced in the furnace, thence passing twice between the staggered rows of tubes, the available heat is thoroughly extracted. This arrangement of the tubes breaks up the current of gases and causes them to impinge upon and wrap around the tubes, whereby the whole surface is made available. The experiments of Dr. Alban, and of the U. S. Navy, have proved that a given surface arranged in that manner is thirty per cent more efficacious than when in the form of fire tubes as usually employed. The rapid circulation of the water also assists materially in the extraction of the heat from the gases, not only by the presentation of fresh water continually, but also by the prevention of incrustation.

Dry Steam.

The rapid circulation of the water in a continuous circuit, in connection with the large disengaging surface in the steam and water drum, causes a thorough separation of the steam from the water, and prevents what is known as "priming" or "foaming," the steam passing away from the boiler dry even when the boiler is forced to its utmost capacity.

Accessibility.

A hand hole at the end of each tube permits access thereto for cleaning should they become scaled by the use of very bad water, and manholes in the steam drum admit access to that part, or the same purpose. Should it be necessary, for any cause, a tube may be readily removed and another substituted. Bonnets at either end of the mud-drum also permit access thereto for cleaning.

Safety from Explosion.

It is now fully established by the experience of boiler insurance associations in this country and England, that all the mystery of boiler explosions consists in a want of sufficient strength to withstand the pressure. This lack of strength may be inherent in the original construction, but is most commonly the effect of weakening of the iron

by strains due to unequal expansion caused by unequal heating of different portions of the boiler; or it may be due to corrosion from long use or improper setting.

The Babcock and Wilcox boiler being composed of wrought iron tubes, and with a shell never exceeding thirty-six inches in diameter, which shell is made of the best charcoal iron 5-16 of an inch thick, has great excess of strength over any pressure which it is desirable to use; and as the rapid circulation of the water insures equal temperatures in all parts, the strains due to unequal expansion cannot occur to deteriorate its strength. Should one of the tubes or T heads give out, which is not at all probable, no explosion could occur, as has been fully demonstrated by experiments; and in case the water be allowed to get so low as to overheat the shell, and cause it to give out, what water remained would be confined to the tubes, and could not cause a destructive explosion like the single large body of water in the ordinary forms of boilers.

Capacity.

The cubical capacity of this boiler, per horse-power, is equal to that of the best practice in tubular boilers of the ordinary construction. The fire surface being of the most effective character, these boilers, will, with good fuel and a reasonably economical engine, greatly exceed their nominal power, though it is seldom economy to work a boiler above its nominal power. The space occupied by boiler and setting is equal to about two-thirds that of the same power in tubular boilers.

Convenience of Transportation.

This boiler may be taken in pieces for transportation. The steam and water drum is never over thirty-six inches in diameter, or more than twelve feet long. The other parts may be readily handled by one man.

Experience with several hundred horse-power of these boilers in operation, demonstrate fully all the above points of superiority.

Mr. Montgomery said that it seemed as if we were traveling in a circle; the same things that were proposed years ago are now again brought forward. He was in favor of government inspectors, who can tell us what are really improvements. Many of our old steamers used to do better work than our present ones. For instance, the steamer "La Fayette," which was in the item of coal, much cheaper

than the Clyde-built ships now running. The inclining of the tubes in the Wilcox boiler he thought objectionable. The tubes should be vertical, to take steam rapidly from the surfaces. In inclined tubes, with a strong fire, the steam superheats and drives the water from both ends.

Mr. J. B. Root said, whether the tubes were inclined or vertical made very little difference. He believed that vertical tubes burnt out faster than the inclined.

After further discussion on the merit of the Babcock and Wilcox boiler, the meeting adjourned.

April 14, 1870.

Professor S. D. Tillman in the chair; Robert Weir, Esq., Secretary.

Professor J. Darby, of New York, read the following paper

On Malaria.

An uninterrupted supply of air is absolutely essential to human life. Two of the elements must be nearly in the same proportions. Nitrogen about seventy-nine and oxygen twenty-one. Besides these two there are always present variable proportions of watery vapor and carbonic acid. In addition to these constant elements, there are many that are sometimes present, but not always, viz., ammonia, nitric acid, hydrocarbons, and generally all volatile materials exposed to the air. *Malaria*, perhaps not volatile of itself, is often in the atmosphere. This material is the subject for our present consideration. Hippocrates says that every sickness has its natural cause, and when there is no natural cause, no disease can exist. According to the same author, most of the disturbing influences of human health come from the air. Many of the directions in Moses' sacred writings have direct reference to hygienic conditions of the air.

Hippocrates classified the conditions of human health into airs, locations, waters and food, and a better classification could not be made at the present time. If these conditions are favorable, health follows, and the human machine wears out by its own limitations. Its original constitution to resist its own action, is the meaning of its durability.

We thus see that at the time of the writings of Moses, 1,500 years before Christ, and in the times of Hippocrates, years before Christ,

the idea that there might be materials in the air that were prejudicial to human health, was prevalent among the Jews and Greeks.

We shall aim to illustrate the following points:

1st. What means have we of detecting malaria?

2d. What are the conditions under which malaria is produced?

3d. What are the nature and properties of it?

4th. The means nature has instituted to destroy it.

5th. The means artificially produced for its destruction.

Before proceeding to the discussion, I shall be excused for introducing a case of personal experience, not because it is personal, but from, to me, the impressive facts it contains. In 1835, I was residing in Macon, Ga., connected with a literary institution. As was my practice after the duties of the day were over, I wandered over the country in pursuit of objects of natural history. I, one evening in the early part of July, having been up the Ocmulgee, returned to a boat yard, occupying a flat space between the river and the bluff on which the city is located. I sat on a piece of timber, and at once felt a strange sensation, as potential in its character as a puff of tobacco smoke in my face would have produced. I immediately became sick, the sickness accompanied by a violent headache. I returned home, which was but a short distance, and was, in one hour from the time of leaving the boat yard, in a violent fever, which assumed the type of malignant bilious. It was an entire year before I entirely recovered. It will not appear strange, that I was deeply interested in the cause of my sufferings. Thousands of times I mentally queried, what was it that I breathed? I made diligent inquiry for light on the subject, but could gather nothing but the fact of the existence of a material called malaria, of which no one seemed to know anything. The Annalles de Hygiene had then been a few years in existence, and nothing satisfactory could be learned from its interesting pages.

Rigana collected bottles of condensed malaria from the Pontine marshes; Bauquelin analyzed it, and found it to be a nitrogenous body, highly putrescible. Thinard and Dupuytrin made the gas of marshes to pass through water, and it deposited a floculent material highly putrescible.

Moscati condensed the vapors over rice fields in glass globes, and at the end of a few hours, at a temperature of about 100° Fahrenheit, it putrefied, giving off an animal odor.

Savi obtained from fœtia emanations a substance which he called *puterine.* By our own experiments we substantiated the facts of the

above observers. But it was only in conditions of considerable intensity that these processes were applicable, and by much trouble and exposure that it could be put in practice. In 1842, experimenting on the compounds of manganese, I found, as was already known, that permanganic acid was very unstable, and its salts more or less so, es ecially when exposed to the air. In testing the effects of various bodies on these compounds, we found some neutral, others hastening the process of decomposition. Oxygen, nitrogen and carbonic acid neutral; ammonia, sulphureted hydrogen, and others, producing instant decomposition. The high intensity of color, compared with the small amount of the material required, gave us the idea of applying it for the detection of our object by special interest. Our hopes were fully realized. By passing air through a solution of permanganate by the aid of an aspirator, the minutest quantity could be detected. By a standard solution of permanganate and a given quantity of water in the aspirator, the relative quantity of malaria was easily and promptly determined. By attaching a long tube to the bulb containing the solution, the air could be drawn from any particular place; from swamps, wells, pools, sinks, beds, under houses, &c. By analysis of the contents of the bulbs when they have become colorless, the constitution of the malaria is ascertained. We now have our first query answered: How can malaria be detected? The answer is, by a permanganate.

2d. What are the conditions under which malaria is produced? Whenever organic materials are undergoing decomposition, with free access of air, with a sufficient degree of moisture and a temperature from ninety to 100 degrees Fahrenheit, one of the results of decomposition is malaria. It is not in swamps or filthy places alone this element is produced, but from every soil that will support vegetation, and from the emanations of our bodies. We have obtained it from common garden soil by moistening it and subjecting it to the appropriate temperature; from the water in which under clothing has been washed, we have obtained it in great intensity.

3d. What is the nature of malaria? On this point the scientific world is divided. One, on which Liebig stands prominent, is what is called the chemical theory. This theory supposes that malaria is a material that is undergoing decomposition, and by contact with highly complex substances, as the blood, produces a change from the normal condition of the blood, thus producing

diseases. This power of a body undergoing change, producing change in a body in contact with it, but with which it has no chemical relations, is well known to the chemist. For a better name he calls it the *catalytic* force. What the force is, or how produced, is not known. The fact is certain, but the explanation of its action is yet to be discovered. In illustration of this theory we may take yeast, which is supposed to be a body undergoing decay. If we put it into a solution of sugar, by its catalytic action it breaks up grape sugar into alcohol, carbonic acid and water. If the amount of yeast is small but little of the sugar will be decomposed, and sweetened water, containing alcohol and carbonic acid, will be left. If the amount of yeast is large, all the sugar will be destroyed. So with malaria. When it enters the blood, through the lungs, it breaks up or alters some of the constituents of the blood by its own change. If the amount is small, but little in quantity, the effect is not serious, but when of great intensity, the result is serious if not fatal.

The other theory, called the germ theory, of which Pasteur is perhaps the originator, considers malaria as germs or spores of microscopic animals or plants. So all spontaneous changes nearly are, by this theory, caused by microscopic animals or plants. The various fermentations are caused by as many varieties of these living organisms. Putrefaction is the result of the same agency. This theory has received the most energetic development, and its advocates have spared no labor in its investigations, and they consider it, by many recorded experiments, to be fully established. They have found the plant that produces chills and fever and have innoculated healthy persons in healthy districts with the germs, and produced what we might call artificial chills and fever. We have no prejudice against the theory, and if facts can establish it, we readily yield our assent; but they must be of a different character from any we have seen recorded. Dr. Saulsbury, of Cleveland, Ohio, deserves great credit for his persevering and laborious investigations. No one who has investigated the subject will deny the presence of germs in malaria, and their presence vitiates our determination of the chemical constitution of malaria. No one will deny any of the facts he has stated; but when he comes to assert that the germs produced the chills, the very point which we wanted, certainly, he fails to give us satisfaction. He did not eliminate from his masses of earth *all* except the "ague palmella," and hence he fails to show that they were the cause of the induced disease.

If in this case the "ague palmella" was co-existing with another material, how does he know that this other material was not the cause? When the "ague palmella" can be applied by itself and the disease supervenes, then the proof is complete.

We are prevented from adopting this theory, without question, by several considerations. It is not to be supposed the spores or germs produce disease as such, but as growing, living animals or plants. Is it within the range of possibility that these germs can be developed, and the beings grow in the space of a few minutes or even hours? In our own case, in one hour the disease produced by the malaria was upon us. The Black Hole of Calcutta, with which you are all acquainted, affords a striking example of the rapidity of the operation of malaria in a concentrated form. There were 146 persons placed in a small room. They perspired profusely, we are told, thus loading the atmosphere with moisture. The temperature was very high. They were incarcerated at eight o'clock P. M.; at eleven o'clock one-half were dead. At six o'clock A. M., when they were taken out, only twenty-three were living, and these in a state of putrid fever, a zymotic fever. Is it possible to suppose that these results were produced by germs? They are the same results that malaria produces, modified by circumstances. By historians, the result is assigned to carbonic acid, which I need not say is wholly inadmissible. The only reason that can be rationally assigned is the putrefying effects of their bodily emanations. In the Pontine marshes, it is not uncommon for healthy men to be struck down in a few minutes and be dead in a few hours. In the island of Antigua, British soldiers, when on duty at the level of the sea at night, are often attacked in a few minutes after exposure, and become perfectly delirious and helpless in one hour and are dead in thirty hours. We consider these cases utterly inexplicable on the germ theory. Again, from all we know of parasitic life, the parasite lives by exhausting the vital fluids of the being on which it lives or wounding the animal, which is a comparatively slow process. It is generally the case that parasites inevitably kill the object that bears them. If these germs grow and reproduce in the system, is it supposable that they spontaneously become extinct; yet cases of chills and fever and typhoid fever are often removed by no medicine, but by simply sustaining the system and a removal to an unmalarious atmosphere. When the microscopic fungus attacks the under surface of the potato

leaf, the rot is fatal unless the affected part is removed. There is no spontaneous suspension. So in numberless instances in plants and animals. We are told these germs are in the breath and in the secretions, in the mouth, etc. This is unquestionably true, and a very strong argument that they were not the cause of the disease of which they are an attendant. They go in and out, and come out as they went in, unaffecting and unaffected.

Some of the properties are very evident. It is heavier than the atmosphere. It is generally within a few feet of the ground. Seldom rising above thirty or forty feet when the surface is level. We have often found it in the yards and lower stories of buildings, but not in the upper stories. It is often discoverable on hill sides when the wind blows from a malarious district. It is probably not a gas, but consisting of excessively minute particles; it rises into the air by the mechanical action of watery vapor. It seems, however, to form an atmosphere of its own, as it obeys the laws of diffusion. This it might do even if it were not a gas.

4th. The means by which nature destroys malaria.—Ozone, vegetation and running water, are the agents nature employs in purifying the air. What we call ozone is simply an active state of oxygen. It is always in the atmosphere when the air is pure. It is produced by the sun's rays on water and volatile oils and by electrical currents. It burns up all putrid and malarious emanations. It is the great scavenger of the atmosphere. We have constructed an instrument for determining the presence of ozone. It is the same as that for detecting malaria. Instead of putting a permangate solution in the bulb, put in a solution of starch with a few grains of iodide of potassium dissolved in it.

This is, in effect, Schonbein's test. He directs the employment of papers smeared with the solution. These papers have never been satisfactory in my hands. The mode indicated above is perfectly determinate and satisfactory. By having a standard solution of the starch compound a perfect determination is attained. The volume of air that passes through the bulk is, of course, exactly equal to the water that runs out, so that if a gallon of air in one place produces the same effect as two gallons in another, the relative intensity is, of course, determined. The instrument for malaria and one for ozone gives the operator the means of determining at once the presence or absence of these agents. If one is present we need not look for the other, as they cannot exist coincidently. If ozone is present malaria

cannot be, and if malaria is present there is no ozone. They are antagonistic, and mutually neutralize each other.

Running water is a great agent for purification. When decaying organic matter enters a running stream, the occluded oxygen in the water immediately burns it up. The motion of the water brings new portions of water to the surface to absorb more oxygen, and it continues its action till all hurtful materials are consumed. The ocean, by its constant motion, accomplishes the same thing. Hence no malarious matter arises from a running stream or from the surface of the ocean.

Vegetation plays a most important part in purifying the air. As all know the surface of leaves is pierced with innumerable mouths (stomata) which drink in carbonic acid and give out oxygen. Malaria cannot pass healthy, vigorous leaves. It either enters the leaf and is decomposed with the carbonic acid, or the oxygen, in the state eliminated, is in the form of ozone and consumes the malarious matter. We have found malaria near the ground under a tree, and ozone among its foliage. The effects of vegetation on malaria have not been very long known, or if known, not acted upon; some even deny its beneficial effects now, but facts are too numerous to leave any doubt on the subject.

We are told that Rome and the plains of Latium were anciently covered with woods, lakes and marshes, and Rome was healthy and Latium was thickly settled. The woods were cut down and Latium became a desert, and Rome was attacked with agues and remittent fevers. In 1695 Rome was visited with much sickness, except one portion surrounded by a belt of trees, which escaped the infliction. We could multiply examples without number by the influence of vegetation in arresting malaria. All swamps are not malarious. A swamp growing the taxodium distichum (bald cypress), nyssa uniflora, with the surrounding trees hung with the tillandsia usneoides (long moss), is sure to be malarious. But if we find the cupressus thyoides (white cedar) pinus serotina bordered with the pinus palustris and tussocks of vigorous grapes, we shall find very little malaria. One accustomed to feel the effects of malaria can at once perceive its presence by its influence. A peculiar sensation accompanied by depression of vital powers and headache leaves no doubt of the presence of this marsh poison. We have often removed these impressions by going to a non-malarious position and breathing with deep and long inspirations for fifteen or twenty minutes. The

malarious matter is, no doubt, burned up in the lungs. Hence in all zymotic diseases pure air and deep breathing is one of the best remedies.

5th. Artificial means of destroying malaria.—Disinfectants, as they are called, may be divided into two classes. Those that destroy the malarious matter and those that preserve it.

In the first class are chlorine, permanganates, chloride of zinc and most of the acids. In the second class stand prominently carbolic acid and its associates, arsenic, corrosive sublimate and some of the acids.

Chlorine is a powerful disinfectant. It has a strong affinity for hydrogen, and probably disinfects by taking the hydrogen from the infectious matter, thus rendering it harmless. Its effect as a disinfectant has been depreciated by some, which must have arisen from ignorance of its properties, or from motives not manifest.

We have employed the permanganates as disinfectant since 1842, and from innumerable experiments, have no hesitation in pronouncing it a perfect disinfectant. It accomplishes the process of disinfection by the production of ozone in its decomposition. Permanganic acid consists of two atoms of manganese and seven of oxygen, which, under ordinary circumstances, is spontaneously decomposed, yielding up three atoms of oxygen as ozone, and being reduced to two atoms of binoxide of manganese. This acid combined with potash, forming the permanganate of potash in solution, is Condy's fluid. For the discovery of the disinfecting properties of permanganate of potash Condy has received much honor from some, at least, of the governments of Europe. We discovered it fourteen years before Condy, and published it one year before he did. We are gravely told that the permanganates are not properly disinfectants, but simply deodorizers. If this be so nature certainly made a great failure. She has made a fatal mistake. A thousand circumstances conspire to prove that she intended ozone as a perfect disinfectant, and this is what the permanganates liberate. We defy any one to show a particle of malarious matter when ozone is present. It attacks decaying matter promptly, and sound or living matter more slowly. Pus, vaccine virus, and any exudation from sores or ulcers, are at once destroyed.

Dr. Beranger Feraud, of the French navy, pronounced the permanganates superior to all others in the accurate experiments he performed with all known disinfectants.

Permanganic acid, and all the permanganates, are unstable under

ordinary circumstances. We were led to make experiments to make them stable, and not impair their properties. Chlorine seemed to fulfill the conditions. The tendency of chlorine is to decompose water, taking the hydrogen, forming muriatic acid, and liberating the oxygen; hence chlorine is one of our most powerful oxidizing agents. The permanganic acid wishes to give up its oxygen, but cannot do it in the presence of chlorine. So they are both unable to change unless some substance is presented which destroys the equilibrium; then they both act with great efficiency. By this combination we have a more powerful disinfectant than either of them alone. We not only had confidence from theory and experiment in the combination, but exposed our life and health depending on its protecting influence for safety. In September, 1856, a party of us went to Florida in a wagon, the most sickly season known for many years. As a sample of the sickness through the country, we give the following circumstances: We came to the Black bayou, and found the boat on the opposite side. We blew the horn, and made all the noise of which our lungs were capable. No one came to our relief. One of the party swam the bayou, in face of the alligators, and got the boat. We crossed and found the keeper of the ferry, and every twelve members of his family, sick with bilious fever, with no one to help them or wait on them. One day we aimed to get to the neighborhood of a village (we camped out every night); but, in consequence of a rain, we were delayed, and just at dark we entered a swamp, when it became so dark that we could see nothing. We came to a dry spot, and stopped and went supperless to sleep. We did not measure or weigh the mosquitoes, but they were enormous and ferocious. In the morning we found ourselves on a piece of dry ground of not more than a quarter of an acre in a most magnificent swamp of Pea river. No human being could, unprotected, have withstood the influence of that intense malaria. (There is a person in this room who was one of the party.) We trusted to our chemical compound, and it did its work, and no one was made sick by the exposure.

We could multiply many cases of our own experience, proving the efficiency of the compound of chlorine and permanganic acid in destroying malaria.

Carbolic acid is an effective disinfectant. It acts by preserving the malarious matter and not by destroying or removing it. It simply preserves. It embalms, but does not remove. It is a powerful antiseptic; like arsenic and corrosive sublimate. We have been sur-

prised at the perfect identity of the action of carbolic acid and arsenious, acid used on organic substances. They are both powerful poisons, as they necessarily must be from their antiseptic properties. Any thing that will arrest change in the tissues or blood of an animal, necessarily destroys its life, if in sufficient quantities. We have no doubt that every condition in which carbolic acid can be used beneficially, arsenic would supply its place. But the name would condemn its use. Creosote, which is only another name for carbolic acid (or perhaps the reverse would be better), could never have assumed the place that carbolic acid now occupies. The name would kill it. Perhaps creosote is the better of the two, as it contains more cresylic acid, of which all carbolic acid ordinarily obtained, contains some. It is, by no means, certain that cresylic acid may not possess the most valuable properties.

Dr. Neuman, of Vienna, Austria, who has experimented largely with carbolic acid, says, carbolic acid is an energetic poison, which acts directly on the nervous system; its external or internal use may cause death. A Mr. Bergen, an accomplished chemist, died from applying carbolic acid to an aching tooth. In the Glasgow Royal Infirmary, the records show that when the dressings in amputations and compound fractures contained no carbolic acid, two in nine died; with carbolic acid, three in nine died. We have no prejudice against carbolic acid. We only wish to place it in its true character, by giving its true properties.

It is a common notion that dry sandy regions are free from malaria. So far is this from being the fact, that such places, especially if near the ocean, are often the very foci of miasmatic vapors. The British army, consisting of 43,000 men, encamped on the island of Walcheren, on the coast of Holland, which consisted of fine white sand, and in less than five months was nearly exterminated. Crooked island in the gulf of Mexico, is a bed of sand, and yet is considered by fishermen to be exceedingly unhealthy in the summer.

The following circumstance revealed to us the explanation. Scattered in the island we found the amaranthus hispidus, growing to immense size, although not a particle of other vegetation around them. Gardeners know that this plant has very long roots running perpendicularly into the soil. On the neighboring main land this plant was growing, and the seeds were borne to the island. Germinating, their roots came within the influence of the subjacent decaying mass, and were thus able to grow and extend their roots to the rich deposit, and

grow in great luxuriance in their sterile bed. This explains the malarious character of the location. The decaying mass beneath sent up its mephitic vapors through the loose sand.

Dr. Vanderweyde said he had listened with pleasure to the paper of Professor Darby, and was sorry that he was not present at the commencement of his remarks. What he has said is sound doctrine. But in regard to ozone he wished to add a few words. It was discovered by Schonbein, and was said to be a particular condition of oxygen. We have an illustration of this in chemistry, as in the diamond, graphite, sulphur, etc. When sulphur is melted a little over 600 degrees, it becomes tough, and when poured into cold water it changes from yellow to red, and then can be pulled out like wax. Schonbein says, why cannot gaseous matter become the same; and this supposition has been adhered to for a long time.

Bunsen says it may be equal atoms of hydrogen and oxygen. And he suggests that it is $H\,O^3$ or $H\,O^5$. Now it seems to be a combination that will very easily give off its oxygen, and then that oxygen will, of course, have very active properties. The oxygen will be in a gaseous condition, and easily set free; the hydrogen will let go the surplus of oxygen and combine with another. The great difficulty is to measure the amount of watery vapor in the atmosphere. We always have a very active oxygen which acts by its peculiar allotropic condition. The decoloration of the iodide of starch, the iodide of potassium mixed with starch has been supposed to be a test for ozone. It has been said that when we find the paper becomes blue by the impression of the ozone, it is a proof that ozone is in the air. But every sweet substance will do the same thing. There is much yet to be found out in relation to this matter, and to what are the best means of purifying the air we breathe. In the city of Philadelphia the water for daily use is pumped up into the reservoirs by steam, and during some seasons the water is not good. As this water has to pass several factories which empty into the river, the least disturbing cause will make it quite turbid. So in the winter season, as soon as the water is covered with ice, it becomes very unpalatable, for the reason that no air can get to the water to purify it, and it is pumped into the reservoirs in its impure condition.

Dr. L. Bradley remarked that the subject of malarious diseases is an important one, and perhaps both the germ theory and the chemical theory may be correct. During his long experience he had met with many of the diseases that are ascribed to malaria. He

resided at an early day in Ohio and western Illinois, and he conceived the theory many years ago by which he had been able to account for the various phenomena of malaria better than by any other. The theory is, that the ordinary diseases ascribed to malaria are not produced by the country or the decomposition of vegetable substances, but that they generally arise from the failure of the animal economy to depurate itself. The formation of new tissues requires the decomposition of old tissues, and in the defection of that matter the material is changed and converted into matter to be again excreted, and if the system fails to carry off this effete matter, it is returned to the system and is the cause of the poisoning. In new countries the system does not seem to have full power to throw off this matter. Animals have been inclosed in air-tight clothing, so as to exclude excretion, and they have died sometimes within an hour. He recently conversed with a traveler who visited the Pontine marshes near Rome, Italy, who told him that now they have stoves in the stages by which the air is warmed, and no ill effects of the malarious air is experienced.

On motion of Dr. Joseph W. Richards a vote of thanks was tendered to Professor Darby, for his able paper on malaria.

Sewing Machine.

Mr. George G. Needham exhibited his improvement in the pedal-motion of the sewing machine, which relieves the operator from the trouble of using the hand to start the fly-wheel when the crank is on the dead center. It consists of a spring so arranged that the crank always comes at a right angle with the connecting rod. The cost of this improvement is about five dollars. It can be applied to any machine. This device has been used on the various popular machines with much success.

Adjourned.

April 21, 1870.

Prof. S. D. Tillman in the chair; Robert Weir, Esq., Secretary.

New Elevated Railroad.

Mr. Robert A. Chesebrough presented a new plan for an elevated railroad. It consists of a series of inclined planes, resting on pillars. The main feature of the plan is the mode of applying the power,

which is by means of inclined planes. The carriage is raised from the foot of one plane to the head of the next by means of stationary power. A double track is supported by steel ropes over the tops of a number of pillars, the tracks inclined in opposite directions. They are elevated above the street twelve feet at the lowest point, and each incline is to be a mile in length. The elevation of the highest point is about thirty-three feet, giving a fall of twenty-one feet to the mile.

On the first 1,000 feet there is a fall of..................	8 feet.
On the second 1,000 feet there is a fall of	5 feet.
On the third 1,000 feet there is a fall of..................	$3\frac{1}{2}$ feet.
On the fourth 1,000 feet there is a fall of................	$2\frac{1}{2}$ feet.
On the last 1,280 feet there is a fall of..................	2 feet.

The pillars may be from 150 to 200 feet apart, and the whole can be constructed for less than $45,000 a mile. A descent of twenty-one feet to the mile will give, it is said, a speed of fifteen miles an hour. By increasing the grade, the speed may be made as great as desired. Air or hydraulic lifts, at the ends of the inclines, are to be used to elevate the cars to the top of the next incline. This mode of construction is stronger than the Greenwich street elevated railway. The motive power to propel the cars is gravity. He proposed to run the cars on this line every half minute. The elevating apparatus can be worked by the city water main. By this system passengers could be carried from the City Hall to Harlem for one cent a passenger. The average speed will be fifteen miles an hour, and the maximum, twenty miles.

Dr. Vanderweyde said there were many fine points in this plan of railway. As to its practical working, we have many instances of it both in this country and Europe. We have inclined railways at our coal mines, and at the Mount Cenis tunnel. At Honesdale, Pa., there is water power appliances to raise the cars up, when they descend a series of inclines and go all the way to Carbondale with no other power but gravity. On some of these sections the speed is twenty-five miles an hour, and that, too, with the brakes constantly applied to prevent the train from running away. The track winds around the Lackawanna river, because a straight line would be too steep, which would be about 2,000 feet above Maunch Chunk. There all the difficulties spoken of here are overcome. The coal trains of some 150 to 200 cars are run without any difficulty. A man sits on a beam projecting some twenty feet in front of the train, and gives

warning of any danger. The charge is only twenty-five cents for the twenty-five miles, that is, for excursion cars, much the same as our Third avenue excursion open cars. The ride is a very pleasant one, and those desirous of an excursion during the summer, could not select a more picturesque route than this road. It would well repay the trouble of a trip there. All the distance is run without a locomotive. The trouble with the Greenwich street elevated railroad is the spreading of the track. It is objectionable on account of the manner in which the columns are constructed. A deviation of one inch of a pillar at the foundation would make twelve inches at the top. The three beams or pillars in Mr. Chesebrough's plan are much preferable. In order to obtain the best results in speed, the cycloid should be adopted to measure the decline. A straight line is not always the shortest way in point of time between two points. The speed of the Honesdale railway is twenty miles an hour with the brakes continually applied.

Mr. John B. Root stated that a twelve-horse power engine at the end of the incline would lift the car, at its estimated weight of some 8,000 or 10,000 pounds, forty feet high every minute, if necessary, and that after deducting all friction. This plan is a tremendous saving, both in point of construction and running expenses.

The Chair remarked that the plan shown in the model before the meeting, embodied in the main, features identical with those proposed and tested many years ago with indifferent and unprofitable results. Even before the locomotive became an assured success, it was tried to operate railway lines by running the cars down inclines and raising them from the foot of one to the top of another by lifts, on a principle similar to that by which boats are raised in canal locks. The lift, however, was frequently regarded as an equivalent of the inclined plane in connecting sections of road at different levels; the grade of railways and the tractive power of locomotives upon different gradients being then not well understood. One proposed apparatus, relating to the combined use of inclined planes for the cars to run on, and lifting machinery to raise them from one incline to the next, consisted of two large cogged wheels placed upon the same shaft and gearing into a pitch chain connected with a vertically moving elevator or platform, upon which the cars could be brought previous to being raised. Although this arrangement was clumsy in design, and manifestly objectionable in many respects, it performed the same function as the hydraulic lift, to which latter the no less serious draw-

back of slow movement might be attributed ; and which, as designed by the projector, involved the laying of a water-tube the whole length of the line, in order that the power might be obtained from a single engine.

When the railway between Albany and Schenectady, in this State, was first constructed, there was a steep incline plane at each terminus. By means of stationary engines, cars were elevated from the valley of the Hudson river, and from the valley of the Mohawk, to the table lands extending nearly from one city to the other. Although the cost of steam power is much less for a stationary engine than for a locomotive, it was found most feasible to dispense with these steep inclined planes, and to elongate the road so as to provide, at each end of it, planes of such grade that the ordinary locomotive could ascend them with the usual loaded trains. On the Pennsylvania railways, for transporting coal, where the load has to be carried down the mountain into the valley below, these steep planes answer a good purpose ; in fact no other plan is feasible. For the pleasure derived from the scenery in these coal regions, some persons venture to ride on the coal trains, which sometimes shoot with frightful speed down the mountain ; but it may be safely asserted that, in general, railway travelers do not admire steep gradients, and would greatly prefer a dead level. Nature sometimes compels the railway engineer to construct heavy grades ; but to construct artificial inclined planes over routes already on a level grade, even though these planes might embrace all the ingenious devices shown in the model before us, seems, to the Chair, to be a retrograde movement, rather than an advance in engineering.

With reference to the same topic Mr. J. K. Fisher took the floor, and expressed his views as follows: No one who knows the history of railways needs to be informed that they were worked by gravitation before they were worked by locomotives; and there is no need of opinions of engineers, or tables or books, to help explain what can be done in this way; the laws of motion, and the resistances, as found by trials with the dynamometer, enables us to calculate very nearly, when we know the hight and length of the inclines. In this case the hight is 10.5 feet and the length 2,640 feet; and the inventor claims that he can attain an average speed of fifteen miles an hour on a series of such inclines, stopping every half mile to change passengers and lift his car up to the summit of the next incline. He does not explicitely state how long it will take to lift the car; but he says it

may be done instantly. Nor does he state how long it will take to change the passengers. On the London underground line it takes forty-five seconds to change passengers; and I believe they do it as quickly as practicable. I think fifteen seconds will be required to lift the car 10.5 feet and start it. Here then we have one minute for each half mile, and one minute is left for running; that is, to get an average speed of fifteen miles an hour, the *mean* speed while running must be thirty miles an hour. To get a mean speed of thirty miles an hour upon a half mile, there must be a much higher maximum speed. I am not now prepared to calculate the acceleration due to the cycloidal curve, half a mile long, which is here represented; but on a plane of this length and fall, the utmost speed attainable by gravitation would be less than twenty-six feet per second, if there were no resistance to rolling, and the mean speed would be half, or thirteen feet per second, or less than nine miles an hour. But the resistance to rolling, at fifteen miles an hour, eleven pounds, per ton; and at thirty miles it is sixteen pounds, on a solid railway in good order. Upon a line with supports, each 250 feet apart, as here proposed, there will be some flexure, whichwill increase the resistance; but take the lowest figures, which give $\frac{1}{204}$ as the resistance. Now the ratio of the height to the length of the inclines is $\frac{1}{251}$ which leaves but a small margin for accidental resistance, such as wind, ice, etc.; in fact, it would be unsafe to depend on so slight a descent to give a speed of fifteen miles an hour if there were runs of ten miles in length. A much greater height than 10.5 feet will be required for such speed as will be economical for passengers—a height so great that it will hardly be practicable above ground.

The plan of Mr. P. W. Barlow, now being imperfectly applied by his son, P. W. Barlow, Jr., in a "subway" under the Thames, would be more feasible in New York, and would give a higher speed than any other plan of railroad yet proposed; in fact, it is the only plan now economically practicable near Broadway; the lots being so built upon, that there is not enough room left for openings for a line worked by locomotives. This plan, I think, will fail to give much speed under the Thames, because the tunnel is so narrow that the atmospheric resistance will be excessive; but a tunnel as ample as that in London might be made on the following plan: Each station to be located in the middle of a block, on a level with the street nearly. From the station the line could descend as steeply as practicable, say one in eight, for a depth sufficient to give a high speed, say sixty

miles an hour; this depth would be 121 feet. The cars could be started by a stationary engine, of sufficient power to give, in the first 200 feet, an impulse that would overcome the rolling and atmospheric resistances, and the car would arrive at the next summit at a speed of six or ten miles an hour. This method of throwing the cars, like shuttles, Barlow proposed, but seems not to have worked out. It is his original idea, so far as it applies to underground railways, and in my opinion it is a good and feasible one. With stations on the street level, the line may dive under all cross streets, sewers, pipes, buildings, and other obstacles to a common line, and do no harm to any of them, even during the construction; and the cost of driving such a tunnel would be far less than the cost of an open cutting, if the interruption to traffic be computed. An average speed of twenty miles an hour is easily practicable on it; whereas, on the London line the average is less than thirteen miles, and cannot be got up to fourteen without lightening the trains.

But the highest speed attainable is on iron-floored undergrade streets, with steam carriages that can pass each other and make long runs; one street being for the down travel, and another for the upward travel, so that collisions if there be any, shall have only the force due to the difference of speed. Frequent stops render high average speed impossible; therefore, railways cannot be the best for city travel. Besides, the flange friction renders the resistance, at high speed, much greater than it would be with plain wheels.

Mr. D. W. Bradley read the following paper on

HOROLOGY IN PAST AGES.

The field which the speaker proposes to review extends from about 700 B. C., to the close of the seventeenth century, and is confined to that branch of horology which relates solely to the clock. He has gathered his data from numerous authors, and is especially indebted for many interesting incidents to Wood's "Curiosities of Clocks and Watches;" he is also under obligations for information furnished by Mr. Wm. H. Worthen, mechanical draughtsman.

It is not known at what period our present method of commencing the day at midnight, began. It was doubtless an invention of the priesthood, and I am not certain that it can be improved; although it does seem odd to call night day. The day actually begins at sunrise and ends at sunset; and this was the earliest method of reckoning. Afterward the day and night were divided into four equal

parts, determined by the rising and setting of the sun, and the passage over its two meridians. Long after this another division was made to correspond with the number of months, viz.: Six parts for the day and six parts for the night. Again, another division was made, of twelve parts for each, or twenty-four parts for the whole period of day and night.

The first mention of the word "hours," occurs in Daniel, 4th chap. 19th verse, about 550 B. C.: "Then Daniel, whose name was Baltestrazzar, was astonished for one hour, and his thoughts troubled him." It is hardly to be supposed that "minutes" were used until a more accurate division of time than either the sundial or clepsydra was devised.

The Romans for nearly five centuries after the building of their city, only observed Sunrise, Noon, and Sunset; Noon was proclaimed by a herald, the moment the sun was perceived between the Forum and Præcostasis.

It will be admitted that those nations which divided the day and night into twelve equal portions, commencing at sunrise and sunset, must have had hours of variable length. It is said that the convents in Italy use this method still; consequently, their day hours in summer run as high as seventy-five minutes in length, and their night hours above forty-five. Their clocks, of necessity, had to be set every night and morning by the rising and setting of the sun. The old clock faces, like that of St. Peters at Rome, were divided into six hours, and the hands go around four times during a day and night. The hour of prime was given out by striking three strokes on the principal church bell; then four, then five, then one single stroke—in all thirteen—to represent the Saviour and his apostles. Then all the churches set their clocks and tolled out the hour. This was repeated at vespers. Iago says of Cassio, "He'll watch the orologe a double set, if drink rock not his cradle;" meaning twice twelve hours. A traveler, in 1729, tells us that the Italian clocks struck one half an hour after sunset, and on progressively to twenty-four, as the hours passed. In some places, he says, the clocks struck twelve, in others only six, and then began anew. He found the clocks at Nuremburg striking from one to twelve, beginning at sunrise and sunset.

In Japan the day and night begin at sunrise and sunset, and are each divided into six equal parts. The Brahmins of India divide the day into sixty hours.

In early times the term "horologium" was applied to every instrument that in any way measured time, whether sun dial, clepsydra, clepsammia or clock. The word "clock" originally meant only the bell used for ringing out the hour, determined by the horologe, and was so applied up to the fifteenth century. The first mention of the word is said to be in a work by Dr. Reginald Peacock, written in 1449.

When Dion, after delivering the Syracusans, spoke to them on the tyranny of Dyonisius, Plutarch says he stood on the top of a lofty sun-dial erected by the tyrant. Many nations had columns erected for casting the sun's shadow, and it seems probable that this was the earliest attempt at time-keeping; yet some authors claim the clepsydra to have been used long before the sun-dial.

In 2 Kings, xxii, 11, we read: "And Isaiah the prophet cried unto the Lord, and he brought the shadow ten degrees backward by which it had gone down in the dial of Ahaz." Now Ahaz was King of Judah from 741 to 726 B. C., while it is very generally admitted that the dial, with a gnomon for casting the sun's shadow, was the invention of Anaximander, who was born 610 B. C., and could hardly have invented the dial 150 years after Ahaz's day.

One author I consulted tells me that "dial" and "degrees" are translated from the same word in the original; but a scholar, to whom I put the question, said that "degrees" was translated from the word that represented the pole, or whatever it was that cast the shadow.

It will not be out of place here to explain the mechanism of the dial of Ahaz, presuming his to be like others of his day and generation. The first requisite was an open and level plot of ground of the proper dimensions; then a very straight and smooth post from fifteen to twenty feet in height, erected near its southern limits next a meridian line drawn by the aid of the north star, and lastly a series of varying semicircles by which to gage the length of the sun's shadow. The time was determined by the length of the shadow cast, and not by the position of the shadow and the distance passed over.

The first sun-dial was set up at Rome by L. Papirius Cursor 301 B. C., and the next near the Rostra by M. Valerius Mesela, the consul who brought it from Catana in the first Punic war, 267 B. C. The Romans, at this time, were not aware that a dial, true for Sicily, was not true for the latitude of Rome. The sun-dial, being of no use at

night or in cloudy weather, did not come into so general use as the clepsydra, although much more reliable as a time-keeper when it could be used.

Authentic representations of the clepsydra are very rare, and the name of the inventor or date of its advent, are not recorded. Vitruvius, a distinguished Roman architect, handed down valuable drawings and descriptions of them, but they have nearly all been lost.

Reed says that in the most remote ages, long before sun-dials were invented, water-clocks had been made, and were used in China, India, Chaldea, Egypt, and Plato introduced them into Greece. One is represented at the Hippodrome, in Constantinople, in the form of an oviform vase. It was mounted on an axis with a handle for reversion, and the time it took for the water to run out was noted. The simplest form of clepsydra was a cylindrical vessel with a float loosely fitting its interior, from which rose a vertical gauge marked with the hours, which, by its gradual ascent as the water entered, showed the passing away of the hours with tolerable accuracy. A similar one had a fanciful figure standing on the float and pointing with a hand to the hour, on a stationary gauge. In some, the water flowed in as tears from an automaton. In some a dial was attached to an axis on which a chain was wound. At one end of the chain was attached a float, and at the other a weight to nearly balance. As the water rose the shaft and dial revolved, while a pointer gave the hour. In others the dial was fixed, and the pointer attached to the end of the axis. This was the origin of our present dial.

The first name mentioned in connection with the clepsydra, is Censor Scipio Nassica, who some claim to have been the first to measure time by night as well as by day, 600 B. C.

They were introduced into Rome about 150 years B. C., and Pompey thought them just the thing to regulate and prevent the babbling of the lawyers, and he ordered them placed in the judicial courts. The Romans called this device the horologium nocturnum or night clock.

Ctesibius, a learned mechanician of Alexandria, has the honor of first applying toothed wheels to clepsydra, about 200 years, B. C. He made a float with toothed column attached, to revolve a shaft with a pointer and dial, but we have a description of a clepsydra made by him, which is more elaborate in design, and gives some idea of the state of the arts at that day. This consisted of a cylindrical column standing upon a square pedestal within which

the mechanism was concealed. This column turned on its axis in one year, and had the hours marked by circles, varying, to show the long and short days, and nights, or winter and summer. Beside this column stood the figures of two boys, one of whom was represented as crying heartily, while the tears fell into a basin, ran across the pedestal in a concealed way, and into a large vertical tube, with its bottom closed. The other boy stood on the cap of a rod, attached to a float resting on the water in this tube, and consequently rose as the water came in, to the right of the column in twenty-four hours. When it arrived at the top a syphon came into play, and the whole contents of the tube was discharged into a bucket of an overshot water wheel. This wheel had six buckets only, and thus performed a revolution in six days. On its axis was a pinion of six leaves driving a wheel of sixty teeth attached to a vertical shaft, and this in turn had a pinion of ten, driving a wheel of sixty-one teeth on a shaft attached to the column, and thus the column was turned fully round in 366 days. In this we find carving, turning, founding, an overshot water wheel, the art of transmitting motion and changing its direction by means of toothed wheels, and the porportioning of numbers of wheels and pinions, and the application of the syphon. The eye of the weeping boy was fitted with a pierced jewel to prevent its enlargement and fouling.

Vitruvius makes mention of a clepsydra which told the hours, the moon's age, the zodiacal signs, &c. The principle was that of a float and toothed column, which, as it rose, drove toothed wheels, and these in turn impelled others, and figures were made to move, obelisks to turn, pebbles to be discharged, trumpets to sound, and many other tricks. The aperture for admission of water in this was a perforated gem.

The so called Temple of the Winds, at Athens, was a clepsydra on an immense scale, and was the time-keeper of the day. It was supposed to have been built by Androndicus Cyrrhestes, and it derives its name from the figures of the eight winds cut in relief on its walls, with their names on the frieze above them. Both Varro and Vitruvius call this a horologium, from its containing an immense water clock, which was supplied from a spring under the cave of Pan, on the northwest of the Acropolis. I can find no description of its mechanical details, and it is in such a state of ruin at this day that nothing definite can be arrived at. All that remains is a portion of the stone aqueduct in which the water was brought. These writers

also say that it was a sun-dial, which I at first suposed meant that the time was determined by the length of its shadow; but its height, being not more than twenty-five to thirty feet, would preclude that idea. On a close examination of a very fine photograph kindly loaned me by a friend, I found a pin protruding from each facade, and from each of these pins curiously arranged diverging lines ran downward. These pins were probably for casting the shadow, and the lines for determining the hour.

It seems to me that the clepsydra must have independent origin in several countries; for when Julius Cæsar invaded Britain, fifty-five B. C., he found them in use among the natives, and by them discovered that the summer nights there were shorter than in Italy.

If we turn to India, we find them there, and they tell us the story of the beautiful Liliwati, daughter of one of their learned men, who, it was predicted, would die unmarried. Her father determined to avert so horrible a fate. He made choice of a husband for her, obtained an astrological determination of a lucky hour, and placed the damsel, adorned as a bride, near the water-clock, to watch and wait for the auspicious time. But alas! the hour passed unnoticed, and, on examining the clock, the lovely creature found that a pearl, becoming detached from her dress, had fallen into the water and completely closed the orifice through which it should have flowed. Her sadly disappointed father, in despair, exclaimed, "I will write a book in your name that shall remain unto the latest time." This he did, and Liliwati is a work known to Hindoo scholars to this day. The Brahmins of India measure the time by means of a copper bowl, with a small aperture in the bottom, which they leave floating on the water. When it gets full they empty it, and strike the hour on a gong, and sometimes on the copper bowl itself.

About the year 800 the King of Persia sent to Charlemagne a clepsydra that presented the first rudiments of a striking clock. The dial had twelve small doors. At each hour a door opened and the proper number of balls fell out at regular intervals on to a brass drum. The time could be seen by the number of doors left open, and heard by the number of balls falling out. At twelve o'clock twelve horsemen in miniature issued forth, rode round the dial and closed all the doors.

The clepsammia or sand-glass was invented at Alexandria about 150 B. C.; it is the hour-glass of the present day. On an ancient bas-relief at the Mattei palace at Rome, representing the marriage of

Thetus and Peleus, Morpheus holds an hour glass; but which some authors have claimed to be a clepsydra. The clepsammia were first made in nearly the form and proportions of the hour-glass known to us, and what is most singular, it has always been the emblem of Time. Before the general introduction of watches it was as common for the preacher to be seen carrying a sand-glass to church as it was his service book, while the more pretentious ones had a man to walk a few steps behind, carrying these necessary articles. This custom was brought down almost to our day, and in New England it was a part of the business of the tything-man to walk up to the pulpit and turn the hour-glass when the parson commenced his discourse. In the days of Queen Elizabeth the Fellows of Colleges and learned men carried sand-glasses in their hands. History tells us that in 1589 one William Wallwood, Professor of Laws, "was going from his house in the town to the college, his gown on, his book in one hand and sand-glass in the other, meditating on his lesson," when one Henry Hamilton issues out of a house and assaults him, and at the first stroke wounded him and mutilated his sand-glass. Hour-glasses were formerly placed in the coffin and buried with the dead to signify that the sands of life had run out.

Early travelers in China and Japan make mention of other methods of keeping time among those nations. One of these was a box about twelve inches long, filled with ashes, into which furrows were drawn from one end to the other, connecting at alternate ends. Into these furrows was sprinkled dried and finely powdered bark of the anise tree. This was set on fire at one end and burned very slowly, while an attendant struck the hour as each furrow was consumed. The burning bark gave off a fragrant perfume, and the whole seems a vision of oriental life.

Another method was the twisting of some material into a rope, with knots at regular intervals. The burning from one knot to another denoted the lapse of a certain time, which an attendant struck on a bell or gong.

One clock-house showed the time by means of filling a vessel of water that raised a board with marks on it. A person standing by gave notice to the people by beating on a drum, and hanging out a placard with letters a foot and a half long, denoting the time.

Candle clocks have also been used. Alfred the Great, when in exile, vowed that if restored to his kingdom he would devote one-third of his time to the service of God. This vow he afterward

fulfilled, and to properly apportion the time, he caused candles to be made that burned four hours each, or six to the twenty-four hours. But when the winds blew, the air rushed in through the crevices of his habitation and caused his candles to gutter and waste. Then the king caused a lantern to be made with very thin horn sides, and his candles burned steadily. Thus he devoted two candles to religious duties, two to public business, and two to recreation and sleep. It required a constant attendant to warn him of the waning wick.

When wheel clocks driven by weights were introduced, is very hard to say. The clepsydra seems to have been brought to such a state of perfection that the transition was very slight and unimportant, and they are so intermingled that it cannot be told where one leaves off and the other commences. We read of the clepsydra up to the twelfth century, and wheel clocks as early as the sixth. Attempts have been made to trace the latter back to Archimides, 200 B. C.

In the fifth century three bishops made a pilgrimage from Britain to Jerusalem, where they were received and entertained with great honor, and on their departure were each presented with a valuable gift. "The last, but not least of these gifts, was conferred on the blessed Teilo. It was a bell, greater in fame than in size, and in value than in beauty. It convicts the perjured and cures the infirm, and, what is more wonderful, that it did sound every hour without being touched, until it was prevented by the sin of men who handled it with polluted hands, and it ceased from so delightful an office." If we remove the superstitious drapery thrown around this statement, we may reasonably find a striking clock underneath, but whether clepsydra or not, is a question. It is known that the clepsydra had been in use in Britain for at least 500 years in some form, and we must infer that those using them had the skill to repair when out of order, hence many authors suppose this clepsydra was a wheel, striking clock.

We find the name of Bothias mentioned as having made the first wheel clock, in the year 510. In 606 died S. Gregory, surnamed the Great, being the third year of Focas, fifty-ninth Emperor of the Romans, who was succeeded by Sabinianus, the sixty-third Pope. He commanded clocks and dials to be set up in the churches to distinguish the hours of the day.

In 756 the first clock was sent to Pepin, king of France, by Pope Paul I.

Pacificus, arch-deacon of Verona, made the first wheel-clock about 850.

Gerbert, a Benedictine monk, and afterward Pope Sylvester II, made the first wheel clock and set it up in his cathedral in 996. Father Gerbert made use of the north star to set his horologia; hence many claim that it was nothing more than a sun-dial. The other makers of the first clock could be just as easily disposed of, for, I think I may safely assert that Alfred the Great knew what was going on in his day and generation, and would not have been likely to use candles to measure time 250 years after Sabinianus commanded clocks and dials to be set up in churches. As to the clock sent to the King of France in 756, it is asserted that the first clock seen in Paris was the one made for Charles V, in 1370.

There is no doubt that the invention of the clock to go by weights took place about the year 1,000, and, judging from the great learning and mechanical skill of Gerbert, I see no reason why he may not have been the inventor; and if a monk made himself a clock-maker, he was, certainly, worthy of being made a pope.

William Marlot, in speaking of Gerbert's clock, makes use of an expression that in plain English means, "Admirable horologium, fabricated by the instrumentality of the devil."

William of Malmesbury says that in his time (about 1100), there was to be seen in the church at Rhiems a mechanical clock which Gerbert had made and "hydraulic organs where the wind, pushed in a wonderful manner by water, made them give sounds modulated like flutes of brass." An interesting point in this connection is that toothed wheels had been in use for more than 1,300 years, and had been used on clepsydra for 1,200 years before Gerbert made his clock.

Reed, in his treatise says: "The college Gerbert attended in Spain had Arabians and Saracens among its professors, and was at that time the only place in Europe where any learning or science was to be found," and that the western Christians were indebted to him for having transmitted to them the system of arithmetic we now use.

In justice to the Arabians I must not attempt getting out of this confusion without giving them credit for their share in inventing the first clock. We are told that they made clocks to strike the hours in 801, and put them in churches in 913, and, I think it quite likely that Gerbert got all his ideas about a clock from the Arabian professors at the college he attended in Spain.

If the Romish clergy were not the inventors of the clock, they

were the earliest patrons of the art. The stated services of the church going on at all times of the day and night, made time-keeping a most important object with them, and there is no doubt that they did every thing to promote and encourage it, while at the same time they had a holy horror of the least progress in astronomy. As late as 1108 we read of the sacristian going out to observe the stars to know at what time to awaken the monks to prayer; and there is no doubt that those who superintended the rude clocks of that early period had a triple duty—first to watch the clock, next the stars, and last of all, to guess at the time.

Probably the first wheel clock running by weights erected in England was at St. Paul's cathedral, London. We have not the date of its erection, but among the records of the church for the year 1286 is found the allowance to Bartholomo Orlogiario, the clock keeper, of one loaf of bread daily for three-quarters of a year and eight days, and also twenty bottae of measures of beer. On November 22d, 1344, there was an agreement made and signed between the dean and chapter of the church and Walter, the "orgoner" of Southwark, in relation to the rebuilding of this clock. This agreement is written in very bad French; but we find that Walter was to be paid six livres sterling for doing the work, was to furnish all the iron and brass, and was to have in return all of the useless material contained in the old clock. It was to be furnished with one dial, and the said Walter with four others were severally pledged, with their heirs and executors and all their goods, that it should be a good clock. By the reading of this document we infer that the first clock had no dial, and only tolled out the hours. Very many of the early clocks had no dials. St. Vedast's, in Foster Lane, London, and the Litchfield and Petersborough cathedrals have faceless clocks. There is now at Leeds Castle, Kent, a clock of the sixteenth century complete in all respects, but without dial works. There was also one at Doncaster; and a butcher church warden conceived the pious notion of placing a dial on it in such a position that it could only be seen from his shop door. But I am digressing and we will go back to St. Pauls, for here we find the first striking automata, called to this day "Paul's Jacks." These were life-sized figures standing along side of the bell with battle axe, hammer or club, according to the design, which at the proper time struck the hours. Much has been written about "Paul's Jacks," and particularly about those at St. Dunstan's, in Fleet street, London. The

author of London scenes says "the giants stood in front of the building on a covered platform each wielding a club, the bell being hung between them, which at the quarter and hour they struck, but so indolently that the spectators complained that they were not well up to their work. They were the pets of cockneys and countrymen.

> "Many a stranger, as he passed that way,
> Made it once a design there to stay
> And see those two hammer the hours away
> In Fleet street."

One historian says, "they were more admired by the populace than the most popular preacher within." The old church of St. Dunstan's was pulled down and the clock and figures were sold to the Marquis of Hertford, October 22, 1830, for £210, and were removed to his villa in Regent's Park where the clubbers still do duty. Another digression.

"In the reign of Edward III a new dial was made for St. Paul's, with all splendor imaginable, having an angel pointing to the hour both of day and night."

The next clock we read of being put up in England was at Westminster, in 1288 or 1289, and the tradition is that Edward I prosecuted Sir Ralph De Hingham, chief justice of the King's Bench, for corruption, and fined him 8,000 marks (another tradition says 800), and with this sum built a clock-house. The offense was that of altering a fine set upon a very poor man, from thirteen shillings four pence, to six shillings eight pence. A clock-house was a separate building from the church, often several rods distant from it. It is not an uncommon thing to see a bell tower built in the same way in some parts of Europe.

A new, large clock was put up in Canterbury cathedral, in the year 1292, at a cost of thirty pounds, and Wm. Benet, who was mayor in 1450, gave by his will four shillings four pence per annum to keep and maintain this clock forever.

At the commencement of the fourteenth century clocks began to multiply, and became quite common in England. Not only large, or tower, but house clocks are mentioned in such a way as to show that they were not considered as great curiosities. Romaunt de la Rose, written in 1305, contains a mention of a clock as a piece of household furniture:

> "And then he made his clocks to strike,
> In his halls and in his chambers,
> With wheels very subtly contrived,
> With a continuing movement."

In the patent rolls of Edward II, 1318 is a grant to Robert Fitzwalter of lands in Pennington for repairing the organ and clock in the Cathedral at Exeter. Striking clocks could not have been uncommon in Italy at this day, for Dante says, according to one translator:

> "Thence as the clock which chimed
> At the hour when the spouse of Idio rose."

A public clock was erected at Padua about 1350, at the expense of Hubert, Prince of Carrara. It was constructed by John de Dondis, a distinguished astronomer, who became so noted that his family went by the name of Horologius, and he by the title of Maitre Jehau de Orloges. He made a curious astronomical clock which he was twenty years in completing. The material used was copper.

John Visconti, archibshop of Milan, set up a clock at Penoa, in 1353.

What the Dutchmen and Germans had been doing all this time, I cannot tell you, but it is very evident that they had not been idle, and their fame must have gone abroad, for in 1368, Edward III, of England, invited over from Deft, three Dutch clock makers, to whom he granted by letters patent safe conduct and protection for one year to carry on their lawful business for their own profit.

Charles V, of France, sent to Germany and invited Henry de Vick to come and build him a large clock for the tower of his palace. This clock is said to have combined all the improvements of the past, and it seems of more than ordinary interest to us, it being the first clock of which we have any drawings, and we have only the time side of this. It was wound every day, struck the hours, had a dial, and one hand. The train is very similar to those of the present day, and it had what is called the crown wheel and verge escapement. Instead of a balance wheel, it had a swinging cross and a weight suspended on each end, that could be moved outward to make it run slower, and inward to make it run faster. The balance staff was suspended by a short piece of rope that reduced the friction on its bearing, besides offering an apology for a balance spring which was then unknown. This was the first clock seen in France, and became quite famous in its early days, an officer being appointed by the king to attend to it, and keep it in order.

Soon after a clock was made by a Frenchman and put up at Montargis, with this inscription: "Chas. V, caused me to be made by Jean of Jouvance."

The balance wheel and swinging cross were the only methods known for regulating an escapement; and the crown wheel and verge was the only escapement known up to the introduction of the pendulum. The balances were of necessity very light, and consequently completely under the control of the train instead of the reverse, as in use at this day. We could not, with our fine machinery and skilled workmen, make such an arrangement keep time. I cannot see that they used any great effort to make them keep time, but I can see the strenuous efforts made to see who could attach the most curious decorations to them.

If you will bear with me I will try to sketch a few of the many complicated clocks built from the thirteenth to the eighteeth century. Among the ornaments attached to one erected at Norwich in 1325, were twenty-four small images, representing the hours of the day, the work of Master Adam, the sculptor; thirty images representing the days of the month, painted plates showing the courses of the sun and moon, besides a large procession of monks.

Richard de Wallingford, son of a blacksmith, built a clock for St. Albans Abbey, at about the same date, which noted the courses of the sun, moon, and fixed stars, the ebb and flow of the tide, etc., and was described as a miracle of art.

An interesting relic was a small brass clock presented by Henry VIII to Anne Boleyn, upon their marriage, in 1532. It is described as richly chased and engraved, and on the top was a lion bearing the arms of England. The weights were engraved with the initials of Henry and Anne within two lovers' knots, one weight bearing the inscription, "the most happye," and the other the royal motto. The movement was made entirely new about 1680, and adapted to a pendulum. Queen Victoria paid £110 and five shillings for it, and it is now running at Windsor castle.

In the inventory of the effects of Henry VIII are enumerated seven clocks of iron and three of copper and gilt. A description of two will give an idea of the whole.

"Item—one clock of iron, having doors of copper and not gilt, with three bells and two men that strike the hour, and upon the top of the bell an eagle, gilt, set upon a case of iron colored red, with three great plumettes, of copper, and three small plumettes to the same, and the clock having the change of the moon upon it."

"Item—one clock of copper and gilt with a chime to the same, showing all the days of the year, and the planets with three moving

dials to the same, one of them being silver, enameled blue, and the twelve signs gilt, with three great counterpoyes of copper, and three very small counterpoyses of like copper gilt."

Queen Elizabeth's favorite, Earl of Leicester, caused a striking clock to be placed in the Cæsar tower, the oldest portion of Castle Kenilworth. Queen Elizabeth visited the Earl in the summer of 1575 and the clock persistently stood still during the whole of her majesty's stay.

We have a record of a very ingenious clock made by Isaac Hobrecht, in 1589. It was in the possession of the court of the Popes at Rome for two centuries, and afterward the property of William I, King of Netherlands; finally it came into possession of an English family. The plan of this clock is almost identical with the Strasburg clock.

One of the most amusing attachments to a clock that we have read of, represents time in pursuit of an old woman, who flies, frantic with fear, at his approach. Time stops and shakes his hoary locks, evidently much amused at her efforts to keep out of his clutches, then turns his hour glass and rushes on in pursuit.

About 1670, Nicholas Prollius, an old veteran warrior, busied himself in his latter days by constructing some curious clocks to amuse his visitors. One of these presented the appearance of an ordinary soup plate, with the hours arranged around its edge. A turtle was seen laying quietly in the bottom, but as soon as the water was poured in the turtle immediately turned and pointed his nose to the hour. If taken out and put back in any position, he directly moved to his former station and continued turning as the hours passed by. In one a mouse was seen crawling along a beam, with the hours marked on it; and in another, a lizard ascended a column. He made another with a dial and hand, and the escapement was regulated by two serpents, who alternately swallowed a small ball.

In 1696, Burdeau constructed a very curious clock, in compliment to Louis XIV. On a throne, surrounded by all the pomp and circumstance of royalty, was seated the king, while around him stood the electors of the German States, and the princes and dukes of Italy. These advanced toward the king, and after saluting him retired, chiming the quarters with their canes. For the kings of Europe was reserved the more dignified office of striking the hours, after having paid their respects. This piece of mechanism so pleased the vanity of the French people that they advised Burdeau to exhibit it in public. The artist consented to do so, and in order to render it more

effective, he determined to make the figure of stubborn William III, of England, to bow more humbly than either of the others. A great crowd collected to view the exhibition, and all went well until king William came forward to make his humble obeisance, when, on the instant, some of the mechanism gave way, and Louis came tumbling heels over head at the feet of the British king. In an hour poor Burdeau was sitting in the Bastile, trying to find the dividing line between the sublime and the ridiculous.

The ancient cathedral at Strasburg contains one of the most complicated clocks in all Europe. The old cathedral is somewhat complicated, too, if we can judge anything by its history. I would like to say something of its many tussles with fire, lightning and earthquakes, but will not put your patience to the test. It was commenced in 510, on ground once occupied by a temple dedicated to Hercules and Mars. Tradition says that these succeeded a forest of sacred wood in the midst of which rose the Druidical Dolman, and further, that at one time "not less than 100,000 vassals and men, who worked for the salvation of their souls," were engaged in the erection of this church.

The first clock was commenced in 1352, and finished in 1354. I cannot find how long it ran; but another was commenced in 1547. I think this was not finished at all, for in 1570 Conrad Dasypodius draw the design of a new one, and the execution of it was confided to Isaac and Josiah Habrecht, two noted mechanicians of the day.

This so-called master-piece of the sixteenth century was finished in 1574, but it is said to have only ran fifteen years. In 1836 the corporation of Strasburg passed a resolution to have the clock repaired, and Mr. Schwilgue, of Strasburg, was intrusted with the work. He began in June, 1838, and completed it at the end of 1842. This new clock differs very little from those that preceded it, and its general features are the same; and although it was built in the nineteenth century, the Strasburg clock really belongs to the latter part of the seventeenth, and it is worthy of description. Standing on the floor three feet from the wall is a great globe of the heavens. This globe turns on its axis in twenty-four hours, while the sun goes through its course in one year, and the moon in one month. On the wall behind this globe is a dial eight feet in diameter, and in the center of the dial is a terrestrial map. On one side of the dial stands Apollo, and on the other Diana, who are said to point to the course of the year and the day thereof. The dial has two sets of

figures, or twelve at the top and twelve at the bottom, and the pointers give apparent time. On the right of this dial is a tablet giving the year of the world, the year of our Lord, all the movable feasts, the dominical letter, Easterday, the progression of equinoxes, &c. On the left is another tablet giving the solar and lunar eclipses "computed forever," one account says. Above these are movable figures representing the days of the week.

Thus, on Sunday, the sun is drawn out in a chariot and stands throughout the day when he is succeeded by the moon; which in turn gives way for the chariot and horses of Mars, and so on. Directly over these is an ordinary dial giving mean time. On the right of this dial sits a winged boy with a tiny bell on which he strikes the hours as they pass, and on the left sits a similar one with an hour glass that he turns at each hour. Above this again, or about the center of the clock, is a large dial showing in what degree and sign each planet is in at every hour of the day. Over this is a recess in which the moon is shown in its proper state, and an index declares its age. Still higher are two galleries one above the other. In the first stands death on a pedestal with a bell on each side. At the first quarter a child comes out and strikes one with an apple. At the second quarter a youth strikes two with a dart, the third is struck by a man-at-arms with a Kalberd the fourth by an old man with a crook. Death strikes the hours. The bells are trivial affairs not more than ten or twelve inches in diameter. In the upper gallery stands the Savior on a pedestal, and at each hour the twelve apostles pass in review before him, each bowing, and as the master raises his hands to bless them, a cock standing on the top, flaps his wings and crows three times. The whole mechanism occupies about twenty feet in height.

The introduction of the pendulum changed the whole theory and practice of clock making. The traps and trickery were all cast aside, and time keeping pure and simple, became the watch word, and perfect accuracy, the goal for which all clock makers strove. The story of the discovery of "isochronal oscillations" by Galileo, is a very pretty one, and I would not spoil it; nay, I often fancy it is 1582, and I see the antiquated old church at Pisa, and seated therein a comely youth of sixteen summers. It seems to me to be a lovely Sabbath morning, and he is thinking of the bright and beautiful fields, of his mates at play, of the birds singing in the groves, and caring little for those by whom he is surrounded; a careless, graceless,

youth—a dreamer. By and by his attention is attracted to a lamp suspended from the ceiling, which having been lighted and let go, is swing to and fro before him. To while away the time he lazily places his finger on his pulse and makes a comparison between them. He observes that the oscillations of the lamp are regular in their changes, and as they die away he is astonished to find that the short ones are made in same time as the long, in other words, that oscillations are performed in equal times. The student now awakes to a new life! A thought has been kindled that shall burn in his soul; an inspiration has dawned that shall make him immortal! He knows not that the Arabians had used the pendulum for at least five centuries, and luckily for him, since the vision might then have faded from his mind, like the fabric of a dream. The first use he made of his discovery was to test the rate and variations of the human pulse, and he soon found that the shorter the pendulum the quicker the vibrations. He wrote a treatise explaining its principles; and it is said, that he suggested its use on clocks, but we have no positive proof touching this point.

Who made the first application of the pendulum to a clock it is very difficult to decide. We have the advertisement of Ahasuerus Fromenteil, dated November 25, 1668, wherein he claims to have the first pendulum clocks made in England, and adds, "you may have them at the sign of the Maremaid in Lothbury, near Bartholomew lane end, London." Formenteil was a German, and must give way to that distinguished Hollander, Christian Huyghens, who adapted a pendulum to a clock in 1657, and made other improvements in horology. The Italians claim that the son of the great Galileo put up a pendulum clock in Venice in the year 1649; the English, that Richard Harris built a clock for St. Pauls, Convent Garden, London, in 1642, and it had a pendulum. But first of all comes the story of poor Tycho Brahe, the great astronomer, who was persecuted and driven from his observatory and home on the little island of Huen; how he went to Copenhagen, where the same blind infatuation followed him; and how he again fled to Prague, where he found protection under the Emperor Rudolphus, who gave him a pension and a castle to reside in. Here he pursued his labors in peace, and here he used in his observations a pendulum clock made by Justus Borgen, clockmaker to the Emperor. Tycho Brahe died in 1601.

All of these clocks had the crown wheel and verge escapement with short and light pendulums and large arc of vibration, conse-

quently their precision of time-keeping was not such as to attract the attention of astronomers and artists to any great extent. Huyghens of Holland soon made the very important discovery that the long and short vibrations were not made in precisely equal times, and he invented the cycloidal checks, which secured perfect isochronism but were not practical.

Wm. Clement, of London, soon after invented the steel pendulum spring, to take the place of the thread or cord hitherto used for suspension. This spring, when made of the proper thickness, had all the advantages of the cycloidal checks, but took a fraction more power. In 1680 Clement brought out the Anchor, or what is usually termed the Recoil Escapement, which allowed of a much longer, heavier pendulum, and a much less arc of vibration. This invention possessed great merit, and Clement seemed fairly on the road to fame and fortune, when, all at once, it occurred to Dr. Hooke that he had invented that escapement twenty years before. The distinguished philosopher Huyghens also invented the retaining power; a number of minor improvements were made by others about this time, but the great and crowning achievement of all was the invention of the dead beat pallet and the mercurial pendulum by Geo. Graham about 1715 to 1720, in which the expansion of the rod is compensated by the expansion of mercury in the opposite direction. The Gridiron pendulum was invented by Harrison about 1726. It keeps the rod of the same length by the expansion of solid metals in opposite directions, but, bringing the center of oscillation too high and always operating by jerks, the Gridiron pendulum can never be made so reliable as that pendulum carrying a cylinder cap of mercury. It will thus be seen that all of the great principles applied in time-keeping have been used for 150 years, or more.

England seems to have fostered and nurtured the art of horology, which is so important to navigators of the sea, but it seems not to have been indigenous to the brain of that country. I have mentioned that Dutch clockmakers were invited to come in and ply their trade; and Frenchmen and Germans must have been invited, or came without, for I find that at the commencement of the seventeenth century there were fifteen clock and two watchmakers in London, and *every one of them was a foreigner.* They had, too, a spice of what Sam Slick would call "human nature" about them, for the moment they got settled in London they commenced clamoring for protection from foreign makers. They asked this favor from James I, and

when Charles I got nicely seated on the throne they commenced operations on him. Finally in 1631 the Clockmakers Company of London was incorporated by royal charter. This company had full powers to make by-laws for the government of all persons using the trade in London, or within ten miles thereof, and for the regulation of the trade throughout the kingdom, and to prohibit the importation of any clocks of foreign manufacture. Power was also given them by their charter to enter any ship, warehouse or shop where they might suspect bad or deceitful works were to be found, with full power to destroy them. The town was divided into districts and periodical searches were made. The company tried for many years to obtain a livery, but did not succeed until about 1765, and on Lord Mayor's day, 1767, they joined in the procession in their new uniform, and, report says, made a genteel appearance. The despotism of this "ring" among the trade had no limits.

I shall close my long paper with a single anecdote illustrating English claims. Wood relates that Dr. Bigsley espied an old and curious looking clock in a furniture broker's shop of London, and inquired of the shopman whether it was Dutch or English. "Oh! English," he replied; it was made by Thomas Fudgit, and I have often seen clocks of his make." The Doctor was puzzled for a moment, but on a closer examination of the much corroded iron dial, he saw engraved the oft-repeated warning, which admonishes me to close, "*Tempus fugit,*" "Time flies!"

Adjourned.

April 28, 1870.

Professor S. D. Tillman in the chair; Robert Weir, Esq., Secretary.

The Chairman presented the following scientific memoranda:

New Colorimeter.

M. Duboseq, of France, has invented a new instrument for measuring the differences of tint in solutions. Two glass cylindrical vessels, containing the liquids to be tested, are placed side by side on a shelf; in each is a smaller tube closed at the lower extremity by a glass disk, which may be raised or lowered by means of a pinion having fastened to it a vernier moving over a graduated scale, so as to measure the distance between the bottom of the vessel and the lower disk of the movable tube. Luminous rays are transmitted through

the bottom of the cylinder, by means of a mirror and by two Fresnel rombs above the cylinder, in such a manner that each will illuminate half of the field with a semi-disk of yellow light more or less intense. These colors are observed with a terrestrial eye-piece formed of four glasses, by which the field may be illuminated with perfect uniformity. The colors are proportional to the hight of the columns, if the liquid contains the same proportion of caramel, or in proportion to the richness of the liquid in caramel, if the two columns have the same height.

Radiant Heat.

Prof. Magnus, in a communication to the Berlin Academy of Sciences, gives the results of his experiences on the emission and absorption of heat radiated at low temperatures, which may be thus briefly enumerated: 1. Different substances heated to 150 degrees Centigrade (302 degrees Fahrenheit), radiate different qualities of heat. While there are bodies which radiate only one kind of heat, others radiate many kinds. 2. Pure rock salt (chloride of sodium) radiates one kind of heat, as the spectrum of sodium shows only one color. It is monothermic, and its vapor monochromatic. 3. It does not permit all kinds of heat to pass through it with equal facility, as stated by Melloni and others; for it absorbs heat radiated by rock salt more readily than that radiated by silvin (chloride of potassium) and other bodies. The absorbing power increases with the thickness of the rock salt plate. 4. The great diathermancy of rock salt does not depend on a small absorbing power for different kinds of heat, but upon the fact that it radiates only a single kind of heat, and consequently absorbs only this, and that almost all other bodies at a temperature of 150 degrees Centigrade, send out heat entirely different from that of rock salt. 5. Silvin behaves like rock salt, but is not monothermic in an equal degree, and bears some analogy to the colors of its ignited vapors, and the spectrum of potassium, which is almost continuous. 6. Fluor spar almost completely absorbs rock salt heat, yet of its radiant heat only thirty per cent is absorbed by a rock salt plate twenty millimeters thick. However, fluor spar radiates three times as much heat as rock salt. 7. If a spectrum of heat radiated at 150 degrees Centigrade, could be formed, and rock salt were the radiating body, only one band would be seen. Silvin would give a more extended spectrum, yet would occupy only a small portion of the spectrum radiated from lampblack.

Ventilation.

From an excellent address by the President of the Institution of Civil Engineers in Scotland, Prof. Macquorn Rankine, we select a single passage: A branch of sanitary engineering not less important than water supply and cleansing is ventilation, but its difficulties and imperfections are, in some respects, of an opposite character. In the branch which deals with liquids and solids, we find that the supply of pure water is comparatively easy, while the removal of refuse involves matters of dispute and perplexity. In the case of ventilation, on the other hand, appliances for the removal of foul air, are well known and extensively used, while the supply of fresh air, though in some cases sufficiently provided for, is in other cases neglected; and there are too many instances of the latter class. We too often see large and splendid public halls, in which outlets for foul air have been most carefully planned and executed at various points of the roof, while the supply of air has been left to the casual opening of a door, or to the currents which the pressure of the atmosphere may cause to enter through drains and soil-pipes, or down disused chimneys. There are many exceptions, however, to this remark to be found in buildings where the supply of fresh air has been amply and skillfully provided; and the number of these exceptions is fortunately increasing. Care should be taken not to under estimate the supply of fresh air required by the inmates of a building; experience has proved that each individual requires at the very least, twenty cubic feet per minute, and if possible, he should be supplied with thirty cubic feet.

Gas for Heating Purposes.

Dr. Ziurek states, in Dingler's Polytechnic Journal, that gas from the brown coal of Furstenwald, five miles from Berlin, will be made on the spot, and collected in Berlin in twelve gasholders, each having a capacity of 750,000 cubic feet. The gas will be carried, as usual, in underground mains, and supplied mainly for heating purposes, at a cost of about ten cents per 1,000 feet. At this rate, it is said, an amount of gas giving the heating power of one ton of the best Prussian brown coal will cost less than fifty cents. The works have been constructed on such an extensive scale, that 2,500,000 cubic feet of gas can be supplied daily.

Pollen Under the Microscope.

In a paper read before the Manchester (England) Literary and Philosophical Society "On Pollen, considered as an aid in the differentiation of species," the author, Charles Bailey, Esq., draws attention to four points, in one or other of which pollen grains of plants belonging to the same genus may be found to differ from each other.

1. *Form.*—It has long been noticed that certain types of pollen are characteristic of the natural order to which the plants that produce them belong. This statement, however, must be accepted with limitations; the compositæ, for instance, have three or four well-marked types, represented by the beautifully sculptured pollen of the chiccory, the minute oval spiny pollen of the asters, calendulas, cacalias, &c., and another form wholly destitute of spines, as in the *centaurea scabiosa.* There are, beside, other natural orders where similar variety occurs. But differences of form are met with in plants of the same genus, by which the one species or the other is readily marked off by its pollen.

2. *Markings.*—Here, again, there is endless variety, and a boundless field for the researches of tired-out, dot-and-line hunters of diatom valves.

3. *Dimensions.*—Some instances of differences observable in the size of pollen grains have already been published by Prof. Gulliver, whose measurements of the pollen of various species of ranunculus show the help that may be derived from this character. *R. arvensis* is nearly twice the size of *R. hirsutus*, their dimensions being respectively 1.470 and 1.888 of an inch.

4. *Color.*—This is not so reliable a character for differentiation as the others noticed, since species differ among each other according to the soil, &c., of the place where they have grown. He remembered gathering, some years ago, near Ashbourne, Derbyshire, a variety of *stellaria holostea*, having a dark purple pollen instead of the ordinary pale yellow. Some objection may be raised to any reliance being placed upon the dry shriveled up grains of herbaria specimens, such specimens being in most cases the only ones obtainable for purposes of investigation; but the structure of pollen is such as to bring into greater prominence the pores, folds, valves, and other markings which are met with on their surface after the grains have collapsed by the discharge of their contents.

In regard to the mounting of these objects for the microscope they show to the best advantage when put up perfectly dry; the cells

should be sufficiently shallow to admit of no more than a single layer, and at the same time deep enough to permit the grains to move about. If pollen is mounted soon after it has been discharged from the fresh anthers, the fovilla is apt to condense on the covering glass, and the slide soon becomes useless. The stamens taken from an unopened flower-bud furnish the best and cleanest pollen, and these should be selected in preference to those taken from the fully developed flower. Canada balsam, glycerin, and other media are occasionally helpful in making out structure; thus the pores of *campanula rotundifolia*, *phyteuma halleri*, and other allied species are made much more distinct when mounted in balsam.

The Gulf Stream.

The Hon. Charles P. Daly, President of the American Geographical and Statistical Society, in his annual address, after giving an interesting summary of important geographical and scientific events which have occurred during the past year, alludes to the latest attempts to find at the far north a passage from the Atlantic to the Pacific ocean. He states that there have been about 113 expeditions from the first under Sir Hugh Willoughby, in 1553, to the present year, specially sent out either to find a northeast or northwest passage, or to reach the pole, or to rescue previous expeditions, or obtain scientific information, the details of which fill nearly 1,000 volumes. The main portion of the address is devoted to a criticism of Capt. Silas Bent's theory, viz.: That the gulf stream of the Atlantic and the warm Japanese current of the Pacific are each prolonged to the vicinity of the pole; where he thinks these currents unite, and discharging their heat, produce an open polar sea. The currents are the prime and only cause of the existence of this sea, and constitute the only practicable avenues by which ships can reach it or the pole; or, to use his own language, the way to the pole is by following the course of these currents, which are water thermometers, and may be termed the thermometric gateways to the pole. In consonance with this theory, Capt. Bent assumes that the northerly branch of the gulf stream extends around the coast of Norway, and runs from thence eastward of Spitzbergen to the pole; and that the Japanese current, *Kuro-Siwo*, is prolonged through Behring straits in a northeastwardly direction, until it encounters and mixes with the other in the vicinity of the pole. There is a powerful current running in a northeasterly direction through Behring straits, known on the maps as the Kamt-

schatka current, which, he concludes, is a prolongation of that upon the coast of Japan.

We shall draw attention at this meeting to only that part of Judge Daly's able examination of this question, which relates to the course and velocity of the gulf stream. He says we have no positive information as to the course of the gulf stream beyond the coast of Norway. In the best and most recent atlases, such as Johnston's Physical Atlas, last edition; the Royal Atlas of 1860, by the same author; the Atlas of the Geographical Society of Welmar, 1868; and Kiepert's (Stiler's) Atlas, which has just been completed in Gotha, there is no agreement respecting it. In the first named of these works, Johnston's Physical Atlas, its course is represented differently upon different maps. The fact that driftwood was found, together with vegetable productions of the West Indies, upon the northwest shore of Spitzbergen, as high as eighty degrees northern latitude, by the Swedish expeditions of 1861 and 1868, indicates that it reaches that far, but as the officers of the last expedition in their report say, "in a greatly weakened state," and the circumstance that bottles thrown overboard in the West Indies have been found upon the coast of Norway, together with the fact that there is a slow current along that coast as far as the flord or bay of Varanger, which keeps the navigation open for that distance throughout the year, would indicate also that an easterly branch of it runs along that coast; but, if it were continued from there to Cape Kanin, and from thence to Nova Zembla, and northerly, as it is represented in Kiepert's Atlas of 1860, we would naturally expect to see its effects in ameliorating the climate of that inhospitable shore, and that Nova Zembla would not be, as it is, so bleak and desolate as to be incapable of maintaining even a permanent savage population.

As the movement of the gulf stream is due to the diurnal motion of the globe, it necessarily diminishes gradually, both in volume and velocity, as it runs northward. The contrast is very great between the same current of the coast of Florida and when it approaches Newfoundland. In passing to the high latitudes of the Arctic seas it is so reduced and weakened that Admiral Irminger, of the Danish navy, in 1853, between sixty-one and sixty-three degrees north latitude, and fourteen degrees eighteen minutes west longitude, found that it ran, during an observation of twenty days, only at the rate of 3.1 nautical miles per day, while, at the end of the Gulf of Florida, in the parallel of Cape Canaveral, according to observations made by

the Coast Survey, under the direction of the late Prof. A. D. Bache, it ran about three nautical miles per hour; off Cape Fear, two miles, and off Sandy Hook (New York), one nautical mile. In a communication to Judge Daly from Prof. Benjamin Pierce, Superintendent of the United States Coast Survey, dated February 15th, 1870, a table is given of the observed velocities of the gulf stream at three stations in the Straits of Florida, the vessel having been anchored in order to make the observations:

Station No. 1.—Latitude twenty-four degrees sixteen minutes, longitude thirty-two degrees twenty-two minutes, current 2.3 miles per hour.

Station No. 2.—Latitude twenty-four degrees thirty-seven minutes, longitude eighty degrees twenty-eight minutes, current 2.0 miles per hour.

Station No. 3.—Latitude twenty-five degrees five minutes, longitude seventy-nine degrees fifty-seven minutes, current 1.7 miles per hour.

It will be observed that by the most accurate measurements yet made the velocity of the stream diminished in less than one degree of latitude seven-tenths of a mile per hour. With its velocity thus weakened, as it is found by observation in the Arctic, President Daly asks, is it reasonable to suppose that it has still sufficient force to carry it to the Pole? And, should it extend so far, how small must be its influence upon the temperature and climate of the Polar basin, embracing, as it does, a million and a half squares miles. It may be further remarked that if this warm ocean river pursues its way through the regions of the Arctic, maintaining an open passage between Spitzbergen and Nova Zembla to the Pole, it is very extraordinary that none of the vessels that for the last 300 years have tried to sail northward and eastward in this direction have never been able to meet with it, but have always been compelled to put back before impassable ice. Is it to be supposed that the many able and experienced seamen, who have been thus baffled in this very region, would have been insensible to the value and importance of a current running steadily to the north, or northeast, if such an one was to be seen, or fail to notice the surface indications of it or its influence upon the calculations of their reckoning?

After some observations suggested by the topics presented by the Chair, the Association resumed the discussion on

Malaria.

Dr. P. H. Vanderweyde spoke on the subject of malaria, and showed how the microscope was used in investigating this matter by exhibiting those instruments, with several appliances of his own invention. He said he brought the microscope here to show what was the sheet-anchor of our hopes in acquiring knowledge on this subject. It reveals to us the secrets of malaria. This arrangement of the microscope exhibited the most convenient way in which solid and liquid substances are investigated. Here we have a device in which is some blood taken from a person who died of the yellow fever; and here is another, filled with blood from cattle who have died of the plague, in Texas, which is nothing but the yellow fever in cattle. These are shown only to illustrate how modern appliances are brought to bear on the microscope. Forty years ago the itch insect was not known; and even after it was discovered, it was some time before it was accepted as an insect disease, and there is no doubt but in time all malaria will be found to be of animal or vegetable growth. The most recent investigations made on this subject are by Dr. Harria, of Vienna. Dr. Harrist, of the Board of Health in this city, sent to Dr. Harria, the bile of cattle that died of the plague in Texas. After examination he found that this bile contained cells teeming with animal life, and that these cells would multiply, and that on the way to Vienna they had developed rapidly; but when nourishment was given them they increased very fast. (The Doctor exhibited a drawing of these animals.) After being placed in saccharine matter for one hour, they have all the qualities of the yeast plant. When fermentation takes place there is always the yeast plant with it. The yeast plant grows on decaying matter. Doctor Harria's investigations led him to the conclusion that there was not the least doubt but that the cause of the cattle disease was nothing but animal growth, which lived at the expense of the blood, and which disorganized the whole system, and in that way caused the disease of the cattle. He made some further discoveries and very curious ones too. There is a plant which is found in the contagious matter of syphilis, and this he found in the highest development of yellow fever. These investigations, apart from their usefulness, purely considered in a scientific way, will throw much light on spontaneous development. They will show that many things are but modifications of others, though now they may appear to be entirely destinct. The parasite of dogs,

birds, and reptiles, and different animals, are but modifications of the same kind. All these will be investigated by the microscope and soon will doubtless shed much light on the development of animal life. From a cell to a perfect animal the same law is followed. They grow together, a partition is formed between them, and one development after another is formed almost without limit. Prof. Agassiz tells us that he has several specimens of animals he has not yet been able to classify. The impression given by the parent determines how far the offspring shall go. Of the reptile it goes so far, but in man it goes farther. In the lower organizations the more numerous are the forms. This is the reason why in the lower forms there is the greatest variety. There is another vegetable cell which is the cause of fever and ague; that cell which is developed in low grounds, on a quiet day when there is no wind, and when the marshy grounds have been dried. This cell will be lifted up in the air, and float over the ground to some three or four feet, and when a person breathes these cells a vegetable organization is generated, and the person will have the fever. A strong wind will prevent this, and the heat of the sun acts in the same way. This explains how persons who walk in the evening on damp low ground will have the fever. A man whose digestion is strong and eats hearty may go through this ground without having the fever. Strong people do not get cancer, which is another vegetable growth. Strong people do not have worms; only the weak ones, so we give them tonics to strengthen them. But it is a useful rule not to expose ourselves when we do not feel strong. When we can fortify ourselves and feel vigorous we can do so without danger. No doubt but very soon most contagious diseases will be proved to have a malarious origin. Attached to the microscope shown was the spectroscope of a compact form. The spectroscope is an important adjunct to the microscope for the purpose here spoken of. The spectroscope is nothing but an arrangement for showing the rainbow colors, but we find that between these colors we have dark lines, and when we pass the light through blood, we have two dark lines. These lines are called absorption lines. There are eight very prominent dark lines in the spectroscope, called *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*. When a little blood is placed on glass and put in the spectroscope, it is analyzed, and the two absorption lines are seen between *e* and *f*, and these are called the absorption lines of blood. No such lines will appear in any other substance. Every liquid will have its own peculiar lines. By applying the spectroscope to the microscope we

have the image much enlarged. The arterial and veinous blood give the same lines. Here is blood taken from a person who died of typhus fever; it shows that the blood is broken up, disorganized; it seems like a membrane stretched tight. The point which he wished to make is, that all contagious diseases have a fatal growth which develops at the expense of the body. Many poisonous substances act like tonics when taken in small doses, for instance carbolic acid. We know that it kills animals. It is now recommended for the small pox. The medical journals mention it as being very successful in that disease. The next thing is arsenic, which fattens horses and other animals, but taken in small doses. Two explanations are given of this action; one is that it kills all animals in the body, and the other is that it retards waste of the system. Many other remedies, which, used with judgment, improve the system. But we must be careful; good food and good air are the medicine. People are very particular about their food, but not so about the air they breathe; probably because it costs nothing, but it is the most important of all, for we can do without food and drink for a long time, but we must have air all the while.

Mr. John B. Root exhibited a drawing of a theory of his in relation to the circulation of the blood. He said it might be termed a drawing of the heart and lungs. The arterial blood has a pressure of not quite three pounds to the inch. Now the mechanical force is the result of the heat power generated through the blood. Here we have the lungs, where the combustion of carbon takes place. The muscles are made of fine laminated fibres; these fibres are flexible tubes, and are collected together in bundles, inclosed in a sheet, so that we find them amply protected from pressure. Now, the circulation is due to nothing more than the mechanical pressure of the contraction of these fibres; the same as the piston in a cylinder. The mechanical force is manifested in the arterial blood much the same as when we put coal on the fire and admit air; the oxygen in the air combines with the coal and forms carbonic oxyd and carbonic acid gas, which pass off through the chimney. When a man has fever he burns up a great quantity of carbon, and thus too much carbon in the system produces fever; and if there is less fuel in the system there is a lassitude throughout the body. He inferred that from the construction of the muscles they operate the same as the piece of mechanism called the toggle-joint.

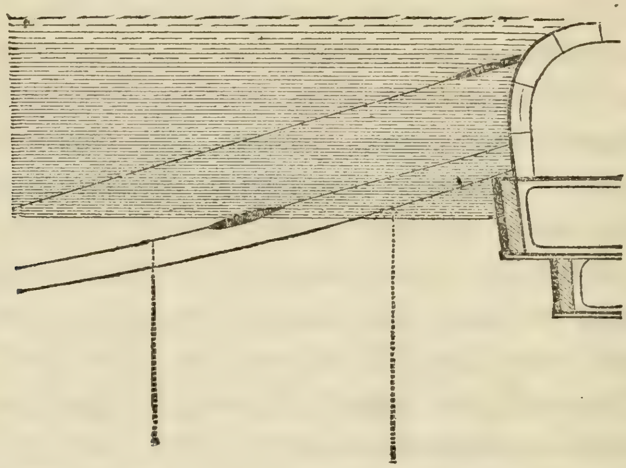
Dr. Vanderweyde remarked that some parts of Mr. Root's theory

were true, while others were not so. Why will a dead body have contraction of the muscles? That the heart is a pump is accepted; also that the combustion of carbon produces heat; but carbon is not burnt in the lungs, for in that case they would be very hot; whereas they are quite cool. The action of the heart serves to propel the blood until it reaches the capillaries, where they take up the blood by suction. All pressure is lost when the blood gets to the capillaries. The extremities of the arteries have no pressure. The capillaries lie between the muscular fibres, and they form a communication between the venous and arterial system. The capillaries extend to the very marrow of the bones; no part of the human body is so full of blood as the brain, yet the arteries do not extend there. The capillaries are filled with blood; they suck it from the arteries; these latter are elastic, and as the blood carries everything with it, so that if lime has been taken from the system, the blood that contains the phosphate of lime will be carried all over the body until reaching the place where the phosphate is wanted, and there it is left. It is simply the nervous system that causes the circulation of the blood.

Safety Boiler Feeder.

Mr. Dunbar exhibited Mr. D. L. F. Chase's safety boiler feeder. The principal feature of this machine is a hollow metallic steam-tight chamber, suspended from one end of a bar similar to a scale-beam, and supported upon knife-edge bearings, the chamber being counterpoised by a suitable weight at the opposite end of the bar. The machine is placed at such a height that the plane of the desered water-level in the boiler shall pass nearly through the middle of the chamber, and the steam and water spaces of the boiler are respectively connected by pipes with the top and bottom of the chamber in such a manner that the water must remain constantly at the same level, both in the boiler or chamber. As the water falls in the boiler, it also falls in the chamber, and the diminution of weight in the latter causes it to rise, though being overbalanced by the additional weight of water in the chamber. Above the balance-beam is the driving shaft, by means of which is put in motion a second shaft, which is furnished, at its outer or free end, with a small pinion revolving between the two parts of a double sectoral rack. This pinion-shaft revolves in a vibratory arm or sleeve, supported on center bearings, in such manner that the pinion may be brought into engagement with either the upper or lower rack. A pitman connects the vibratory

arm with the balance-bar, so that an upward movement of the chamber shall cause the pinion to engage the upper rack, and *vice versa.* In this simple and elegant manner a to-and-fro movement of the rack is obtained dependent on the varying water-level; and this motion is utilized by simply connecting the rack, by means of chains, with the supply-valve or pump.



Mr. Norman Wiard said all appliances of this kind are simply pump meters, or bulk measures. What we want to know is the pounds of water in the boiler.

Mr. T. D. Stetson remarked that it is very important to maintain a level of water in locomotives and steam fire engines, where the tubes are very numerous and the water spaces consequently very narrow. This machine appears to be a sensible, practical one. This apparatus, he thought, would keep the water to within half an inch of the ordinary level.

Mr. James Montgomery stated that the best instrument for this purpose was that of Mr. Worthington, who invented a percussion gauge, which strikes the water and shows its exact height. Some years ago he proposed and tried a system of weighing the water by placing the boiler containing it on a scale beam, and this showed how many pounds of water had been worked off. But, on reflection, he threw this away, as he was satisfied that the people would not pay for a device like this.

Mr. N. Wiard remarked that he had seen steam coming from the lower gauges of boilers, while water showed from the upper ones.

Mr. Charles E. Emery said that we may take it for granted that when a boiler is found to have water on the top and steam at the bottom, it is a defective one, and should be condemned at once. In good boilers water will never uncover the crown-sheet. In badly

constructed ones this may be so; but that should be understood in order to have ones that will do the work economically. A good boiler should have a proper separation of water and steam, and the water should be so arranged as to let the steam rise fully to the surface. In the boiler feeder here shown, everything is seen at once, and it may be considered a good thing. He had seen engineers who thought they knew so much that they would start the engine and go and take a nap, and for this reason there are many intelligent engineers who will have no device for securing safety, but trust to their own care and watching. If a bridge is constructed, we make it four times as strong as the weight it will ever have to bear, and many water detectors are faulty on account of not having power enough to overcome any unusual circumstance that may occur, so they fail often from very slight causes.

Mr. Emery here made a drawing on the blackboard of the apparatus used by Alban, the German engineer, author of a work on the high pressure steam engine. This float, by its power, he said, would overcome any defects that might casually arise, while the hollow float would not have power to do so.

The Chairman announced that the proceedings of this evening would be the last reported in the next volume of the Transactions of the American Institute, which will embrace the doings of the Polytechnic Association from May 1st, 1869, to May 1st, 1870.

Adjourned.

PROCEEDINGS

OF THE

PHOTOGRAPHICAL SECTION

OF THE

AMERICAN INSTITUTE.

May 4th, 1869.

Abraham Bogardus, Esq., Vice-President of the Society, in the chair; Mr. Oscar G. Mason, Secretary.

Mr. Kurtz exhibited a very fine specimen of a photograph burnt in on porcelain, by his process, as detailed at a recent meeting of the section. He also exhibited a beautiful sample of his "Rembrant effects," produced by a peculiar method of lighting the sitter. The print was on albumen paper, and finished in India ink.

Mr. Mason presented two sterographs, showing the effects of syphilitic necrosis on the skull.

Mr. Thomas presented a fine imperial card print, copied from one of the celebrated "Meade daguerreotypes," which were made by Mr. Meade, of New York, while visiting, soon after his great discovery.

Mr. Newton gave the details of some recent experiments in the use of the coffee process, illustrating his remarks by a large number of stereoscopic negatives, which he had made and developed with the following solution:

Water	16 ounces.
Gelatine	16 grains.
Ammonic sulphate of iron	1 ounce.
Proto sulphate of iron	1 ounce.
Glocial acetic acid	4 drachms.
Tartaric acid	8 drachms.

Mr. Chapman gave a sketch of some work which he had recently done on dry plates, and exhibited a negative made by the collodio bromide of silver process, which he had worked out some two years

ago, and detailed to the photographical society. The collodion used in the production of the negative exhibited, was exposed to bright sunlight one day, and to diffused light several days, and then kept in the dark a few hours before use.

Professor Tillman remarked that the negative was a good illustration of the mechanical theory advocated by Mr. Cory Lee, of Philadelphia.

Mr. Boyle exhibited and explained the practical advantages of his double field comet seeker, which is so constructed as to enable the observer to examine twice the amount of space seen in the ordinary instrument of the same aperture. Mr. Boyle also exhibited and explained his model of the moon, which he had recently finished.

The Secretary distributed to members, samples of albumen paper, which was manufactured in Europe, and received from Mr. Willy Wabach, the importer and agent for its sale, at 43 John street, New York.

Mr. Hill exhibited a print by Herr Colbert's process, which was discussed at the last meeting of the Section.

Mr. T. S. Reed suggested the use of carbolic acid in the printing bath; he had added two drops to each ounce of his solution, and found it improved its working quality.

The Section then adjourned to the first Tuesday in June.

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une 1, 1869.

Professor Charles A. Joy, Vice-President, in the chair; Mr. O. G. Mason, Secretary.

Mr. Newton and Mr. Mason gave verbal reports of the progress made by the committee appointed by the Section to investigate the properties and working advantages of the Alcaline silver bath, recommended by Mr. McLochlin, of England. As some importance had been attached to the peculiarity of the nitroli of silver crystals, described by Mr. McLochlin, the committee had decided to experiment with solutions of crystallized nitroli which had been variously treated, and with crystals found under different conditions, as well as with fused nitroli.

The Chairman remarked that if the heat was raised above a certain point, say to a dull red heat, nitrate acid would be formed, changing a part of the nitrate, to nitrite of silver.

Mr. S. P. Reed stated that he had found a very remarkable improve-

ment in the working quality of an *old* bath after long continued exposure to sunlight. The old method of exposing for one or two days, only served to *begin* the action which, if allowed to continue by long exposure, produced changes which were unmistakably beneficial.

Mr. Newton said he had made some modifications in his developer since giving the formula at the last meeting of the Section. He found that the gelatine was precipitated by the ammonia, when the solution was kept in the dark, therefore he had discontinued its use. He also adds eight, instead of four grains, of tartaric acid, as given in his formula. The developer was designed for dry plates only.

Mr. Boyle suggested photographing clouds for the stereoscope by the simultaneous work of two photographers located at somewhat distant points, say one-eighth or one quarter of a mile, so as to be able to signalize for exposure.

After discussion and calculation, it was decided that the proper distance between the cameras should be about sixty feet.

Mr. Chapman thought that the distance between the operators should be greater than that suggested by Mr. Bayley, as the ordinary stereoscopic camera gives good relief only to such objects as are within a distance of eighty rods.*

Mr. D. C. Chapman then read the following paper:

Preparations of Collodio-Bromide Plates.

Mr. President and Gentlemen—The subject to which I wish to call your attention for a few minutes this evening, is the preparation of dry plates without a silver bath, the collodion being sensitized before flowing upon the plate. Three years ago I tried this process and had very fair success, but found that there was a marked difference between the compounds prepared at different times, but what made that difference I was not then able to discover.

This spring, having occasion to use some dry plates, I again tried this same process, with several kinds of preservatives, such as tannin, gallic acid and sugar of milk. Gallic acid, acetate of lead and acetic acid, as published by Mr. Cary Lee, also coffee and sugar of milk, as used by Mr. Newton, and am decidedly in favor of the latter.

The manner in which I work is as follows:

To eight ounces of ether add ninety-six grains of gun cotton, one hundred and twenty-eight grains of bromide of cadmium, thirty-two grains of bromide of ammonium, and one ounce of alcohol. This bromized collodion should stand three or four weeks, then carefully

filter, and when wanted for use, dissolve in seven ounces of alcohol, one hundred and ninety-two grains of silver. If the alcohol is fully ninety-five per cent, it may require to be warmed a little, and the silver pulverized very finely. I also find it advantageous to expose the silvered alcohol to sun light one day. When all dissolved, filter the solution; now decant about double the quantity of bromized collodion wanted to use, and add to it a portion of the silvered alcohol, in quantities not exceeding one or two drachms at a time, and shake well after each addition, until the silver is slightly in excess, which I ascertain by pouring a small quantity of the collodion into half an ounce of water, and shaking well, then, by the addition of a little salt, it will readily be seen if there is any free silver present. If the silvered alcohol is added in too large quantities at a time, there will be a precipitate formed, which will require much shaking to dissolve. In about one-half hour after the last quantity of silver is added, the compound will be ready for use, but will not keep good in this condition more than three or four hours. As soon as the plates are all coated, a quantity of the bromized collodion should be added to the remaining portion of the sensitive compound; this addition will give it keeping qualities, in proportion to the amount of bromized collodion added. If the bromized collodion is largely in excess, it will keep several weeks, if not in excess, it will keep but a few days. I develop with the alkaline developer.

Prof. Tillman called attention to the propriety of some action upon the matter of photographing the total eclipse of the sun on August seventh. After discussion by several members, Mr. Mason offered the following motion:

That the American Institute be requested to appropriate the sum of five hundred dollars, to be expended under the direction of Lewis M. Rutherford, in photographing the total eclipse of the sun on the seventh of August next. The motion was seconded by Prof. Tillman, and unanimously carried.

Mr. Boyle exhibited a drawing of his double field telescope, and explained its advantages in use.

Mr. Mason presented six stereographs of pathological specimens at Bellevue Hospital.

The Section then adjourned to the first Tuesday in November.

November 2, 1869.

Prof. S. D. Tillman in the chair; Mr. O. G. Mason, Secretary.

Mr. Newton, Chairman of the Committee on McLocklin's Negative Bath, gave a verbal report of his experiments in exposure of silver crystals to sunlight since the last meeting of the Section. He had been able to make a first class negative by sensitizing in a plain alkaline solution of sunned crystals of nitrate of silver without iodizing.

Prof. Tillman remarked that the interesting fact of a plain solution being strongly alkaline by merely exposure to sun light, as stated by Mr. Newton, deserved to be followed up by further investigation.

Mr. Mason gave a description of several experiments which he had made in exposing silver crystals and solutions to sunlight during the summer in furtherance of work before the committee. He had exposed crystals to sunlight after having carefully sealed them up in bottles, from which the air and all moisture had been expelled, and into which he had introduced glass tubes containing various alkaline reagents.

Mr. Newton exhibited several very fine negatives made by the tea process, as detailed by him at a previous meeting of the section. He also exhibited a collection of unmounted prints from tea plates five by eight inches, which gave evidence that the process was adapted to first class work when properly manipulated.

Mr. Kurtz exhibited two eight by ten negatives, and prints from the same, saying that one of his reasons for presenting them before the Section was for the purpose of demonstrating the fact that all his best results were *not* produced from retouched negatives, as he understood that many believed, and several had stated such to be the case.

The negatives and prints were admired and highly spoken of by those present, and led to considerable discussion upon the claims of photography and photographers among the arts and artists.

Mr. Boyle exhibited drawings and described his large refracting stereoscope, which consists of two achromatic prisms for eye pieces, which should be of sufficient power to refract two rays of light which would diverge from the observer into a direction which would converge as their distance from the observer increased, and intersect each other at about the distance of twenty inches from the eyes. The centers of the two pictures viewed will coincide at this point and form one picture, and as the original position of the pictures before refraction by

the prisms, coincided with lines which diverged from the observer, it is evident that if we place two pictures of say three feet in diameter at the distance of ten feet, that when viewed through the prisms, they will appear to be brought together at the point of convergence. When these prisms are placed on the point or in front of this field lens or opera glass, the effect is very good, though while the opera glass magnifies the image, it also decreases the size of the field, making it necessary to increase the distance from the picture in order to take in the whole of it.

He also exhibited a view lens, constructed on the principle of the Stanhope eye glass. The stop or diaphram is formed by the glass being turned away at the center; the glass being solid there are only two surfaces at which the light suffers refraction, and as all the light has to pass through the small central opening, the oblique rays are corrected for color in the same manner as in the unachromatized globe or ratio lens. They may be made achromatic in the usual manner, or may be made by cementing together two plano-convex lenses, one of the lenses having been roughened so as to prevent the light passing through anywhere but at the central opening. They give a correct figure the same as the globe or ratio lenses. Mr. Boyle stated that the one shown had much too large an opening for its size and focal length, and therefore answers only to illustrate the principle. They are so small and portable that a traveling operator may carry half a dozen in his vest pocket, and they may be made so cheap as to be sold, like chestnuts, by the quart or pint, or the different focal lengths in papers, after the manner of mixed candies.

Mr. Boyle exhibited an instrument as an attachment for one of his binocular telescopes, which changes it into a binocular microscope for viewing objects at a distance of about twenty inches, and is therefore useful for studying the operations of insects without disturbing them at their labors. The same attachment will also answer for viewing binocular pictures with the telescope, which gives a fine magnified effect.

The section then adjourned to the second Tuesday in December.

December 7, 1869.

Professor Charles A. Joy, Vice-President of the Section, in the chair; Mr. O. G. Mason, Secretary.

Mr. Newton exhibited a sample of alkaline negative solution made from nitrate of silver crystals which had been exposed to the sun, and a negative which he had made on a plate sensitized in the solution exhibited. He used a number of test papers before the Section, which made the condition of the solution apparent to all present.

Professor S. D. Tillman remarked that the discovery made by Mr. Newton was singular, and likely to lead to important results. Assuming the proof positive that crystals of pure nitrate of silver, when exposed to direct sunlight for a given time, will be changed in appearance and, it seems, in character also, since an aqueous solution of this neutral salt after such treatment has been shown to be decidedly alkaline, the nature of this change becomes a question of great interest, because it differs from any chemical action before observed. He did not believe that the alkalinity of the compound was due to a single element, but was the result of the unusual combination of two elements, resembling somewhat the action by which the volatile alkali ammonia is produced by the union of three atoms of hydrogen with one atom of nitrogen, neither of which in a separate state exhibits any characteristics which would lead us to suppose that any alkaline compound would result from their combination. The body under consideration contains nitrogen, which, as regards its atomicity, is generally a triad, its least quantivalence or saturating power being tri-atomic, and as seen in the case of ammonia, one atom of it is capable of holding three atoms of the monad element, hydrogen. The strongest reason for supposing that silver may play the same part as hydrogen is that both are monatomic. Only nine other elements are usually classed among monads, namely, fluorine, chlorine, bromine and iodine among the electro-negatives; and lithium, sodium, potassium, rubidium, and cœsium among the electro-positive simple bodies.

If we suppose that the presence of water is necessary to the consummation of this change, we may represent the new combination by following the example of Berzelius, who regarded even an aqueous solution of ammonia as the oxyd of ammonium, the latter being a hypothetical compound consisting of four atoms of hydrogen and one atom of nitrogen. A molecule of water and of nitrate of silver

belong to the same type, distinguished as the water type, and are designated by the following symbols:

$$\left.\begin{matrix} H \\ H \end{matrix}\right\} O \qquad \text{and} \qquad \left.\begin{matrix} NO_2 \\ Ag. \end{matrix}\right\} O$$

in which the atomic weight of oxygen is doubled, that is $O = 16$. To those who have been chemically educated under the old system, it may be well to explain that the nitrogen atom being a triad, and two atoms of the dyad oxygen, having the same quantivalence as a tetrad, the saturating power of NO_2, is the difference between a triad and a tetrad, that is, $4 - 3 = 1$. An atom of silver, expressed by Ag, being a monad, it will be seen that the atomicity of the atoms included in the second bracket is virtually that of the atoms included in the first bracket of the first named symbols. For reasons which need not be here given, I prefer not to recognize the hypothetical compound ammonium, and to show the combination of the bodies represented in the first named symbols, which is said to produce a body having alkaline characteristics, I would arrange them after the double water type, thus:

$$\left.\begin{matrix} NO_2 \\ H \\ H \\ Ag. \end{matrix}\right\} O_2$$

Finally, it may be observed that a change in chemical structure does not necessarily involve a change in chemical functions; but the typical formula expresses more clearly the new part which, it is now supposed, may be played by silver, and which, if confirmed by further experiments, will become the starting-point in a new series of discoveries.

Mr. Chapman said he had not been able to detect any increase of sensitizing in the alkaline solution. He expressed doubts of such solution proving any more sensitive than a new slightly acid solution made from the same sample of silver crystals.

In answer to a question by Mr. Chapman, the chairman stated, that a solution made alkaline by ammonia, would be more likely to change or loose its alkaline condition than one in which one of the metallic alkalies had been used.

Mr. Kurtz exhibited a model of concave backgrounds, and explained the method of using the same. He also exhibited several very fine negatives and prints from the same.

The negatives and prints were entirely plain, and Mr. Kurtz stated that he exhibited them for the purpose of proving more conclusively that his best results were not "always from retouched negatives."

On motion of Mr. Thomas a unanimous vote of thanks was tendered to Mr. Kurtz for the exhibition of his concave background.

Mr. Kurtz stated that he did not contemplate patenting his device, but that he intended to enter a caveat for his own protection, and the protection of photographers who might choose to adopt his method of lighting for portrait work.

Mr. Bierstadt exhibited a collection of Albertypes from the establishment of the inventor of the process. The prints were of various sizes, from a few inches square to twenty by twenty-five inches, and were much admired.

The Chairman gave a general description of Albert's process, and exhibited a series of prints by the process; he also spoke of some recent experiments by M. Dehiroin upon the effect of the luminous rays of light.

It was found that the carbonic acid in leaves of plants was decomposed; also, that water was more rapidly evaporated by the yellow and red rays; also, that there is a relation between the decomposition of carbonic acid and the evaporation of water.

Mr. Chapman called attention to the publication in "Photographic Mosaics for 1870," of a process for rectifying a disorganized, positive, printing, silver solution, accredited to Mr. England, and stated that he had published the same process some five years ago, corroborating his statement by reading portions of his original publication, and giving date and page of other periodicals in which it might also be found.

Mr. Hull remarked that he had become quite indifferent to such appropriations of improvements, first brought out in America, he believed it had become a fixed custom with our trans-atlantic brothers. One of his own inventions, some ten years after its extensive publication in this country, was patented by a Mr. Bull in England, and some time later he had seen his siphon print washer very nicely constructed in porcelain and stamped with the patent mark of some enterprising Frenchman.

Mr. Hull spoke of the very imperfect classification of photographs at the late exhibition of the Institute, where some misunderstanding had arisen from the various constructions put upon the classifying term "*plain photographs*," and for the purpose of having the matter

fully understood at future exhibitions, he offered the following resolution, to be laid before the Board of Managers as the sense of the Photographical Section:

Resolved, That all photographs which are not retouched upon the positive, except for the removal or obliteration of *pin-holes*, *comets*, or such imperfections as may result from trifling defects in negative or paper, shall be termed *plain photographs*.

After discussion by Messrs. Hull, Kurtz and Mason, the resolution was unanimously adopted.

The Section then adjourned to the first Tuesday in January, 1870.

January 4, 1870.

Prof. S. D. Tillman in the chair; Mr. O. G. Mason, Secretary.

Mr. Mason exhibited a cabinet size print, made on plain Sax paper, in year 1854, and toned in the ordinary compound bath of hyponiphoti and gold, then in general use. The print showed but little, if any, changes. Mr. Hallenbeck, who received the print from the maker, Mr. H. O'Niel, after making some remarks regarding the process used, presented it to the Section as a sample of the early work on paper in New York.

Mr. Weeks exhibited a small vignette, on melainotype plate, and described a reflector of silvered white crystal glass, which he used for reversing the image in his camera. He stated that he was able to photograph a figure reflected from this glass in less time than was required if the glass was removed, and the figure photographed direct without reflection.

Mr. Bierstadt presented a copy of the specifications of J. Albert's patent on the Albertype, which was read by the secretary; then followed a general discussion upon Albert's process, its merits and demerits.

Various methods for obtaining reversal of the image were suggested by members. The use of a reflector in making the negative; working through the glass plate supporting the film in the camera; rendering the light parallel by the use of a lense, or a long box, and printing with a negative; were among those named.

Mr. Hallenbeck called attention to a recently published formula, introduced by H. O'Niel, for sensitizing albumen paper, which was discussed by Professor Vanderweyde, Mr. Newton and Mr. Anthony.

The peculiarity of the formula was the use of muriatic acid in considerable quantity.

Mr. Anthony had upon trial found that the process gave very fine results, and recommended its trial by those present.

In answer to an enquiry by Professor Vanderweyde as to whether any of the members had tried the use of florine, which he understood the photographers of Paris had worked with success, Mr. Anthony stated that he had experimented with florine some years ago, but failed to produce satisfactory results.

Mr. Newton had also used florine, but met with little success.

Professor Tillman said that doubtless many of the members present would recollect the remarks which he had made upon the use of florine at a meeting some years ago, and he yet believed that compounds of chlorine and florine would not be found as sensitive as those of iodine and bromine, although, like the latter, they belonged to the halogens, and might contain some property available for photography.

Mr. Mason called attention to the importance of artificial light suitable for photographic work in dull or stormy weather. After a short discussion upon artificial light, in which Messrs. Boyle, Hallenbeck, Vanderweyde, Anthony and Chapman took part, it was decided to take up the subject of solar and artificial light for further consideration at the next meeting.

The Section then adjourned to the first Tuesday in February.

February 1, 1870.

Vice-President Bogardus in the chair; Mr. O. G. Mason, Secretary.

The Secretary reported a list of articles and pictures which had been donated to the Section during the year 1869.

Mr. Hull presented, for Mr. Kurtz, a series of ten very fine imperial card prints which very plainly illustrated the great variety of lighting possible to produce in one room, each print showing different treatment, and all good.

Mr. Bogardus presented an eight by ten portrait print of Henry Meade, father of Meade Brothers, who were among the first and most successful daguerreotypists in New York.

Captain Russell presented ten by thirteen prints from negatives which he had made during the last summer among the Wachito

mountains and along the line of the Pacific railroad. Upon request of several members he narrated many incidents of his summer work. In some instances he had transported water as far as seventy miles in order to secure negatives in districts where no water could be found sufficiently free from foreign matter to admit of its being used in photographic manipulations.

His apparatus had been manufactured expressly for work on the great plains and in mountain districts, and was, in all its parts, as light as consistent with the required strength. The camera which he exhibited, and with which he had made over 1,000 negatives, consisted of a cone bellows, the supporting wood work of which was strongly strapped with brass and supported by a detachable base in the form of a cross, along the shaft of which ran a brass-edged groove, into which was fitted a sliding rod. To the front end of this rod was attached the small end of the bellows frame carrying the lense, while to the back end was fixed the focusing screw. When the camera box was removed from its consiform base and the bellows closed, it packed in a light case about sixteen inches square and six inches deep, the whole weighing but a few pounds, which he considered an important feature when working many hundred miles from the outskirts of civilization, with no means of transportation, except by refractory mules, occasionally indulging in a roll down the mountain side, and keeping their load under at least half the time.

Captain Russell had, on some occasions, with his assistant, carried his entire apparatus fifty miles from camp, remaining out several days, living on wild game during the entire trip. At one time, while making views on the shores of a lake 11,000 feet above the sea, he was obliged to suspend operations during a continuous storm which raged three weeks.

At the close of Captain Russell's remarks, upon motion of Mr. Anthony, it was ordered that the approval of the camera exhibited by Captain Russell, be entered upon the minutes of the Section.

It was also ordered that an engraving and electrotype duplicates of the same be made for publication in American journals, together with a description, which Capt. Russell was requested to furnish.

On motion of Mr. Anthony, the following resolution was unanimously adopted:

Resolved, That the American Institute be requested to place to the credit of its Photographical Section, one hundred dollars, to be applied in engraving such apparatus and novel inventions as relate to photo-

graphy, for publication in the journals devoted to this branch of the arts.

Mr. Bierstadt exhibited a very large and beautiful collection of positive collodion, or collodio-chloride prints, transferred to colored and bronzed paper by William P. Dewey, of Paris.

The impressions of bronze work and coins were particularly remarkable for their fidelity to the originals.

Mr. Boyle suggested the use of mounts of graded tints for landscape work, which would admit of representing a blue or clouded sky, with a foliage green or earth tint in the foreground, thus giving a more truthful representation than can be obtained by the use of one uniform tint throughout the dark or shaded parts of the entire picture.

Mr. Bierstadt presented several of the collection to the Section.

Mr. Mason presented four sterographs showing variations in crystillization of bromide of ammonium.

The Section then adjourned to the first Tuesday in March.

March 1, 1870.

Vice-President Bogardus in the chair; Mr. O. G. Mason, Secretary.

Professor Tillman called attention to the nomination of officers for the ensuing year, and offered the following ticket:

For President, Charles A. Joy; *Vice-Presidents*, Abraham Bogardus, Chas. W. Hull, Henry J. Newton; *Secretary*, Oscar G. Mason.

Which was unanimously recommended for appointment by the organizing committee.

Mr. J. F. Adams exhibited and explained his magnetic stereoscope, in which the pictures for exhibition were placed in a receptacle above an octagonal frame or cylinder containing a series of small magnets, so arranged as to retain the picture in position for examination by the magnetic attraction exerted upon strips of lined iron, with which the ends of the slides were bound. The ingenious device attracted marked attention, and its merits were discussed by several members.

Mr. Robert Price exhibited an improved letter and picture envelop, so constructed as to be used for mailing, like the ordinary envelop, and when opened for removal of manuscript matter, the picture envelop yet remained uninjured.

Mr. Anthony exhibited and presented two ten by twelve prints, of Derbyshire spar goods. The fine detail of parts, lustre, and very delicate rendering of the light and shade was quite remarkable. Mr. Anthony stated that the negatives were developed by an organic developer containing sugar.

The Chairman presented an eight by ten print, portrait of a lady.

Mr. O. G. Mason read the following paper:

Artificial Light, and its Application to the Purposes of Photography.

To the great majority of photographers, peculiar circumstances of time and condition have doubtless suggested the necessity of some method for the artificial illumination of objects which are so located as to be beyond the reach of direct or reflected solar light, in sufficient quantity to impress an image upon the most sensitive plate or film in the camera.

The photographing of intricate machinery in dimly lighted manufactories or in mines, and the interiors of public and private buildings, located in narrow streets of densely populated cities, or overshadowed by thick foliage, are cases which cause the photographer no little perplexity.

To the professional portrait photographer and copyist, a cheap, and strong actinic light would prove a source of convenience and wealth.

That *solar light* (even when reflected without too great loss of actinic force) is preferable to any other light with which we are yet acquainted, I think no one doubts; but that direct sunlight cannot at all times be obtained, has been sufficiently demonstrated within the last three months, during which time we have had a very small per cent of good weather for photographic work in general, and that the most perfect system of reflectors (within practical limits) *do* and *must* fail to direct even a single beam of solar light to very many points where actinic light is required, I think many practical photographers have had occasion to observe. While in one department of photography, namely, that connected with microscopical investigation, some method of artificial light is indispensable, especially is this the case in large towns or cities, where the vibrations caused by heavy machinery and vehicles of traffic are such as to utterly exclude the *possibility* of producing well defined impressions during the business hours of the day, as a simple calculation will make plain. A vibra-

tion or motion of the sitter or object to the extent of .1000 of an inch would not be seen in ordinary photography; but any one will readily understand that when such motion is magnified, for instance, 1000 times by the objective of the microscope, we then have, instead of .1000 of an inch, *one full inch of motion*, shown in the resulting image, which would make it far from satisfactory. And when we consider the minute pencil of light used in working with a lens, the diameter of which does not exceed the one-twentieth of an inch, and a focal length of one-fifteenth or one-thirtieth of an inch, and that with such conditions the relation of light and shade must be maintained on objects *invisible* to the naked eye, it will at once be apparent that in using either direct or reflected *solar light*, the motion of the earth and consequent continual change in the angle of the incident solar ray must not be disregarded.

To constantly change the position of the apparatus to compensate for this, requires a most delicate and nicely adjusted mechanical device, or we must maintain the impinging light in a constant direction by the use of a heliostat. But when the atmosphere is so charged with vapor as to obstruct the direct rays of the sun, our work must stop; diffused light illuminating an object placed in the focus of a microscopic objective of high power, produces an image far too weak for recognition by nitrate of silver.

With a good artificial light, constant in direction, and amount of actinic force, and at the same time easy to control, we may work at night when the vibration from streets and manufactories have ceased.

Up to the present time science has given us but few methods for producing light, at all adequate to the ordinary purposes of photography.

All successful experiments thus far seem to have been conducted by the use of electricity, burning the metal magnesium, and the combination of the two gases, oxygen and hydrogen, and in the presence of zirconia and lime, all of which give off more or less actinic force when raised to an incandescent heat. Of these, electricity with carbon pencils is by far the most energetic.

The instantaneous flash of no other light will produce effects of equal intensity. Its entire volume seems to be made up of concentrated actinic power, which justifies us in placing it *first* of all artificial lights. Its use has been limited by the cost of production, and inconstant amount of light, owing, in a great measure, to imperfect methods of application.

Burning magnesium, estimated to produce a light one-twelfth as brilliant as the sun, has been the favorite artificial light for the photographer during the last ten years, but its cost, and the expensive nature of the apparatus, for its proper use, are far too great to admit of general adoption.

Next, we have the well-known oxy-hydrogen or calcium light, which, although of dazzling brilliancy, gives off only about one seventy-third part the actinic force found in the solar rays.

Recent experiment, however, has shown that, by substituting for the pencil of oxyd of calcium, one of the compressed oxyd of magnesium, the power of this light is so greatly increased as to render it suitable for the production of enlarged negatives and prints on paper, such as are now classed under the head of solar camera work. Such a method of illumination presents several advantages, among which are small cost and simplicity of application. Most persons, with little experience, would be able to manage it successfully.

Doubtless, one of the principal sources of failure in the use of artificial light, has been *non-actinic color in the lens* through which the light passed for condensation or formation of the image in the camera.

Many photographers have noticed that lenses, after having been in use a long time, allow the passage of less actinic light, and, consequently, require a longer exposure of the subject. In some cases so great has this change been that the lens became utterly worthless for ordinary portraiture.

The experiments of Faraday, Gaffield, and Pelouze, covering a period of forty-five years, have proved that the action of sunlight produces a change in glass by an exposure of only a few hours, and that such change increases as the exposure is continued.

Therefore we may readily conclude that some change of a like nature is constantly going on in the lenses of our cameras, even when exposed to *diffused* solar light.

Many opticians, in selecting glass, consider only its density and homogeneous structure, totally disregarding tint, unless the color is very decided.

That great variety of color exists in both flint and crude glass, especially the latter, may very readily be seen by inspecting the stock of any dealer in the various qualities required for optical purposes.

The photographic lenses from one Paris firm have for a long time been celebrated for the rapidity of their action, which seems to result from color alone. When carefully examined, they present no novel feature of configuration or extraordinary amount of polish. In the *flint* portion of their lenses, no color can be detected, while the crown shows a delicate pale blue tinge, instead of the green or yellow so often seen upon a close inspection of many lenses.

By any one who has experimented (photographically) with decomposed light, the effect of this color in a lens will at once be understood. It is believed that all the obstacles thus far presented, may be surmounted, and a cheap, effective, easily managed artificial light produced, suitable for many of the constant requirements of photographers; and, to meet these conditions, no means now seems more promising than that offered by compressed hydrogen and oxygen gases, united in proper proportion at or near the point of ignition, and the flame thus produced directed upon a pencil of the oxyd of one or more of the metals before named. For some purposes, it would doubtless be advantageous to impart to the light a tint of blue or violet, by the admixture of some color-producing property in the pencil upon which the flame impinged, while, in the selection of our condensing lenses and objectives, especial attention should be given to color in the glass; and all lenses for photographic purposes should be protected from solar light, even if diffused, at all times when not in actual use.

M. Boutemps (managing director of one of the celebrated crystal glass works of France), after a long and careful study of the subject, attributes the change to the oxydizing effects of the sun's rays upon the metals used in manufacturing the glass.

Mr. Chapman made remarks upon the great necessity for a good artificial light, especially in large towns and cities.

Mr. Anthony described some experiments which he made some years ago, in the production of very sensitive collodion plates. He had succeeded in producing plates so extremely sensitive that he was obliged to manipulate in perfect darkness; the faintest ray of artificial light produced a foggy image. He had not succeeded in making the process practical, but might renew the investigation.

The Section then adjourned to the first Tuesday in April.

April 5, 1870.

Mr. Henry T. Anthony in the chair; Mr. O. G. Mason, Secretary.

Mr. Hallenbeck gave the following formula for printing in dull weather, and stated that by it he had produced very good prints, which could not at the time have been made by any of the ordinary processes:

Float plain paper three minutes on water 20 oz., bichloride of mercury five grains. Hang up until thoroughly dry, then float for one minute on a thirty-five grain solution of nitrate of silver, and after drying and exposure under negative the image is developed with water ten ounces, proto-sulphate of iron 350 grains, glacial acetic acid four ounces. As the paper is very sensitive it should be kept protected from actinic light after it has been sensitized, until the image is fully developed.

Mr. Chapman deemed the development of the image with iron as a very important feature, as many experimenters had not been able to preserve clearness and fine detail, with an iron developer on paper.

The Chairman thought that the success of the process was in a great measure due to the organic matter used in sizing the paper while in the process of manufacturing, and the varying nature and quality of which might explain the great variety of results obtained in the developing process on such light and porous material.

Mr. Dimmers stated that a very similar process had been published some years ago, and that one of his friends had worked it successfully in solar printing.

After some further discussion upon the process by several members, Professor Tillman moved that a committee consisting of Messrs. Hallenbeck, Chapman and Dimmers be appointed to experiment with the process given by Mr. Hallenbeck, and report at a future meeting of the Section. The motion was unanimously carried.

Mr. Chapman exhibited a four-inch negative of the sun, and made remarks upon its characteristic features, some of the larger spots, with their surroundings, faculæ, were plainly shown in the image.

Mr. Newton exhibited samples of albumenized paper, which had been sensitized on the 31st day of December last, and had not changed; also a print made on the same day and toned on the first day of April; also another print on the same paper, made and toned on the last named day, all of which very clearly demonstrated that

there had been very little, if any, material deterioration in the working qualities of the paper.

The sensitized paper had been rolled with alternate sheets of printed blanks, inked on both sides with ordinary printing ink, which seemed to have thoroughly protected it from atmospheric and actinic changes.

Mr. Newton stated that he did not think it necessary that both sides of the paper should be inked.

Mr. Anthony gave an account of experiments which he had made in the preservation of sensitized paper, by floating the sheets upon distilled water, immediately upon removing them from the silver solution; they turned brown in a few days, while that floated on plain water kept one month.

He has kept paper so prepared several months without apparent change, except a slight tendency to a very light yellow tinge.

Mr. Mason stated that he had early in March began a series of experiments in the preparation of sensitized paper, by floating the sheets upon various acid solutions, after removal from the silver, and that he had thus far been unable to detect any change in their appearance.

After some discussion upon the subject, Mr. Anthony suggested the appointment of a committee, and Mr. Hallenbeck moved that a committee of three be appointed to continue experiments upon the preservation of sensitized papers, and report the results to a future meeting of the Section.

The motion being seconded, Mr. Chapman nominated for such committee Messrs. Newton, Mason and Anthony, who were appointed.

Mr. Mason presented, for Mr. P. F. Weil, three prints from negatives made by a missionary in Africa, they were especially interesting as illustrations of scenery and domestic life in that country. Mr. Mason presented four stereoscopic and six medium prints of interesting pathological specimens taken at Bellevue Hospital.

He also exhibited his modification of a small equatorial telescope stand, with reflector attached so as to serve the purpose of a heliostat.

He also laid before the Section a copy of Commodore B. F. Sands' report of the late total eclipse of the sun, and several photographs made by the government expedition.

Mr. Anthony exhibited a series of prints by the Lichtdruck process, from the establishment of Orr & Grossman, at Berlin, Prussia.

Mr. Kurtz exhibited a series of very fine imperial case prints, illustrative of effects produced in the use of his concave back ground, which he described as a *papier-maché* dish, or section of a sphere, six feet across and two feet deep, so mounted as to be placed at any desired elevation or angle.

After some general discussion upon its merits and the beautiful effects produced, the Section adjourned to the first Tuesday in May.

INDEX.

A.

B.

C.

N.

O.

P.

ERRATA.

Page 818, line 17, for " destructive," read " distinctive."
819, last line, for " river," read " rim."
820, line 7, for " is," read " in."
827, seventh line from the bottom, for " basis," read " basin."
828, line 25, omit the word " more."
883, for the title " beachwood tar," read " birchwood tar."
1069, in fifth, seventh and ninth lines from the bottom, for " nitroli," read " nitrate;" in third line from the bottom, for " nitrate acid," read " nitrous acid," and in the sixth line from the top, for " Mr. Cory Lee," read " M. Carey Lea."

The engraving on page 1066 does not illustrate the text, and was inserted by mistake.